SCIENCE

VOL. 100 FRIDAY, SEPTEMBER 8, 1944 No. 2593

The American Association for the Advancement of Science:
Preliminary Announcement of the Cleveland Meeting: Edited by DR. F. R. MOULTON 203

Agar Resources of the South Atlantic and East Gulf Coasts: HAROLD J. HUMM 209

Obituary:
Norton Adams Kent: PROFESSOR ROYAL M. FRYE and PROFESSOR LUCIEN B. TAYLOR 212

Scientific Events:
Industry and Research in Great Britain; Beit Memorial Fellowships for Medical Research; Twenty-five Years of Botany at Butler University; The Annual Meeting of the Optical Society of America 212

Scientific Notes and News 214

Discussion:
Freedom in Science: DR. SYDNEY ROSS; DR. BART J. BOK. *Visiting Research Professorships:* DR. CARL E. SEASHORE. *Geomorphic Significance of Valleys and Parks of the Kaibab and Coconino Plateaus, Arizona:* ARTHUR N. STRAHLER 217

Scientific Books:
Text-books of Physics: PROFESSOR THOMAS D. COPE 220

Special Articles:
Further Studies on the Relationships between Xanthopterin, Folic Acid and Vitamin M: DR. JOHN R. TOTTER, VIRGINIA MIMS and DR. PAUL L. DAY. *Vitamin A Toxicity and Hypoprothrombinemia:* ROBERT F. LIGHT, RUTH P. ALSCHER and DR. CHARLES N. FREY. *Cottonseed Phospholipids:* DR. HAROLD S. OLCOTT 223

Scientific Apparatus and Laboratory Methods:
Proposed Use of Starch Sponges as Internal Surgical Dressings Absorbable by the Body: CLAUDE W. BICE, DR. M. M. MACMASTERS and DR. G. E. HILBERT. *Molecular Weight by Isothermic Distillation:* PROFESSOR JOSEPH B. NIEDERL and PROFESSOR DAVID R. KASANOF 227

Science News 10

SCIENCE: A Weekly Journal devoted to the Advancement of Science. Editorial communications should be sent to the editors of SCIENCE, Lancaster, Pa. Published every Friday by

THE SCIENCE PRESS

Lancaster, Pennsylvania

Annual Subscription, $6.00 Single Copies, 15 Cts.

SCIENCE is the official organ of the American Association for the Advancement of Science. Information regarding membership in the Association may be secured from the office of the permanent secretary in the Smithsonian Institution Building, Washington 25, D. C.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

PRELIMINARY ANNOUNCEMENT OF THE CLEVELAND MEETING

Edited by F. R. MOULTON

PERMANENT SECRETARY

AFTER a lapse of two years during which the American Association for the Advancement of Science has held no meetings, it will meet for the fifth time in Cleveland, Ohio, from September 11 to September 16, inclusive. The previous meetings in Cleveland were held in 1853, 1888, 1913 and 1931. In 1852 a meeting scheduled for Cleveland was canceled because of an epidemic of yellow fever along the Ohio River and farther south. There have been fears that this meeting would have to be canceled because of the war.

This preliminary announcement has been delayed because of constant changes in the programs due to the uncertainties that have prevailed during the past few months. The choice has been between an early announcement that would be erroneous to an appreciable extent and an announcement so late that it would not be of maximum value. In spite of all difficulties the program will consist of many notable sessions, though in number of scientific societies meeting with the association and in the number of papers presented will fall far below several meetings immediately preceding the war. But it may be confidently expected that after the close of the war scientists will resume their normal work and their meetings with increased enthusiasm.

HOTELS AND HEADQUARTERS

General headquarters of the meeting will be at the Hotel Statler. The headquarters of sections and affiliated societies are distributed among hotels as follows:

Statler: Sections on Physics, Zoological Sciences, Anthropology, Psychology, Social and Economic Sciences, History and Philosophy of Science, Medical Sciences, and Education; American Society of Zoologists, American Society of Parasitologists, American Microscopical Society, American Society of Naturalists, Ecological Society of America, Union of American Biological Societies, National Association of Biology Teachers, American Psychological Association, American Association of Applied Psychology; American Statistical Association, Econometric Society, Society of the Sigma Xi, Sigma Pi Sigma, Sigma Delta Epsilon, National Association of Science Writers, American Society of Aesthetics.

Carter: Sections on Mathematics, Astronomy, and Agriculture; American Society for Horticultural Science.

Cleveland: Sections on Chemistry, Geology and Geography, and Engineering; Research Council on Problems of Alcohol.

Hollenden: Section on Botanical Sciences; Botanical Society of America, American Society of Plant Physiologists, Mycological Society of America, Sullivant Moss Society.

All reservations for rooms should be made through the Cleveland Convention Bureau, 1604 Terminal Tower Building, Cleveland.

REGISTRATION

Registration will be on the mezzanine floor of the Hotel Statler, beginning each morning at eight o'clock. All persons attending the meeting are expected to register (registration fee, $1.00). Each registrant will receive a copy of the General Program of the meeting.

OFFICIAL MEETINGS

The *Executive Committee of the Council* will meet at 4:00 P.M. on Sunday, September 10, in the Permanent Secretary's room in the Hotel Statler.

The *Council* of the Association will meet at 2 P.M. on Monday afternoon, September 11, in Parlor L, Hotel Statler. Later sessions will be held in the same room at 9 A.M. on days to be determined at the first meeting.

The *Academy Conference* will be held in Parlor L, Hotel Statler, on Monday, September 11, at 3:30 P.M., or immediately following the meeting of the Council. This conference will be followed by the Academy dinner at 6:30 P.M. in the Hotel Statler.

GENERAL SESSIONS

On Monday evening, September 11, at 8:15 P.M., Dr. Isaiah Bowman, president of The Johns Hopkins University, will deliver an address as retiring president of the association in the Music Hall of the Cleveland Public Auditorium. The title of Dr. Bowman's address is "Commanding our Wealth."

On Tuesday evening, September 12, Dr. Edwin J. Cohn, of Harvard University, will deliver the twenty-first Annual Lecture under the joint auspices of the American Association for the Advancement of Science and the Society of the Sigma Xi, in the Music Hall of the Cleveland Public Auditorium. Dr. Harlow Shapley, president of the Sigma Xi, will preside. The subject of Dr. Cohn's address is "Blood and Blood Derivatives," a subject to which he has made notable contributions during the war period.

On Wednesday evening, September 13, Dr. Shapley will deliver the eighth Annual Lecture under the joint auspices of the American Association for the Advancement of Science and the United Chapters of Phi Beta Kappa, in the Music Hall of the Cleveland Public Auditorium. The subject of Dr. Shapley's address is "A Design for Fighting." Dr. Raymond Walters will preside at this session.

On Thursday evening, September 14, Dr. Matthew W. Stirling (and Mrs. Stirling), chief of the Bureau of American Ethnology and leader of six archeological expeditions into the wilds of southern Mexico, will deliver an illustrated lecture in the Music Hall of the Cleveland Public Auditorium. The title of the lecture by Dr. and Mrs. Stirling is "National Geographic Society-Smithsonian Institution Archeological Expeditions to Southern Mexico." Dr. Anton J. Carlson, president of the association, will preside at this session.

GENERAL SYMPOSIA

At conferences of secretaries of sections of the association and of associated societies, held in Chicago and New York on February 20 and 27, 1944, respectively, it was recommended that adequate time at the Cleveland meeting be devoted to general sessions on the larger problems of science, such as science and the post-war world, with particular emphasis upon rehabilitation, education, and research.

To carry out that recommendation, at least in part, the following symposia have been organized. Tuesday afternoon, September 12, 2:00 P.M. in the Lattice Room, Hotel Statler.

RESEARCH AFTER THE WAR: THE NEED FOR A NATIONAL POLICY ON RESEARCH

Informal discussion by members of the Committee on Science and Society, Lawrence K. Frank, *Chairman,* and invited speakers.

Wednesday morning, 10:00 A.M., in the Pine Room, Hotel Statler, under the chairmanship of Howard R. Tolley, chief of Bureau of Agricultural Economics, U. S. Department of Agriculture, a symposium will be held on "The Role of Science in United Nations Collaboration for the Improvement of Nutrition and Agriculture after the War." The participants are Dr. Frank G. Boudreau, director of the Milbank Me-

morial Fund; Professor Robert Rae, University of Reading, Reading, England; Mr. P. Lamartine Yates, British Minister of Agriculture.

Wednesday afternoon, 2:00 P.M., in the Ball Room, Hotel Hollenden, under the chairmanship of Dr. G. M. Smith, a symposium will be held on "Biologists and Rehabilitation." The participants will include E. G. Butler, Princeton University; Frans Verdoorn, Arnold Arboretum; Robert F. Griggs, George Washington University, and W. F. Loehwing, University of Iowa.

SPECIAL SYMPOSIA

American Psychological Association, American Association for Applied Psychology, Psychometric Society and the Section on Psychology will hold a joint symposium on Monday morning on "Graduate and Professional Training of Psychologists."

On Monday afternoon, September 11, a general conference on "Publication Problems in Biology" will be held under the chairmanship of John E. Flynn, editor-in-chief of *Biological Abstracts*. The participants in this important conference will be Dr. Flynn; Robert F. Griggs, Division of Biology and Agriculture, National Research Council; Zeliaette Troy, Boyce Thompson Institute; R. E. Buchanan, Iowa State College; Herman H. Henkle, Library of Congress; Fernandus Payne, Indiana University; and Paul Weiss, The University of Chicago.

Also on Monday morning and afternoon the Subsection on Dentistry will hold sessions of a symposium on "Fluorine and Dental Caries."

On Tuesday morning, September 12, five symposia sessions will be held: (1) "Quartz—Geology and Mineralogy," by the Section on Geology and Geography and the Section on Physics; (2) "Parasitology in Relation to the War," by the American Society of Parasitologists, American Society of Zoologists, and the Section on Medical Sciences; (3) "Psychology and Post-War Problems," by the American Psychological Association, the American Association for Applied Psychology, the Psychometric Society and the Section on Psychology; (4) "History and Philosophy of Science in Post-War Education," by the Section on History and Philosophy of Science; (5) "Alcoholism," by the Research Council on Problems of Alcohol.

On Tuesday afternoon four symposia sessions will be held: (1) "Quartz—Physics," by the Section on Geology and Geography and the Section on Physics; (2) "Aims and Needs in the Philosophy of Science," by the Section on History and Philosophy of Science; (3) "Alcoholism," by the Research Council on Problems of Alcohol; "Genes as Physiological Agents," by the American Society of Zoologists.

On Wednesday morning, September 13, two symposia sessions will be held: (1) "Teaching Ecology," by the Ecological Society of America and the Section on Education; (2) "Alcoholism," by the Research Council on Problems of Alcohol.

On Wednesday afternoon five symposia sessions will be held: (1) "Biologists and Rehabilitation," by the Botanical Society of America; (2) "Medical Mycology," by the Mycological Society of America; (3) "Tropical American Bryophytes and Lichens," by the Sullivant Moss Society; (4) "Science and the New World," by the Section on History and Philosophy of Science; (5) "Alcoholism," by the Research Council on Problems of Alcohol and the Committee on Alcoholics of the Welfare Federation of Cleveland.

On Thursday morning, September 14, a joint symposium on "Nutrition" will be held by the Section on Botanical Sciences, the Botanical Society of America, the American Society of Plant Physiologists, the American Society for Horticultural Science, and the Section on Agriculture.

On Thursday afternoon three symposia sessions will be held: (1) "Catalysis," by the Section on Chemistry; (2) "Biology and Human Progress," by the American Society of Naturalists and the American Society of Zoologists; (3) "Premedical Education," by the Section on Medical Sciences and Alpha Epsilon Delta, National Honorary Premedical Fraternity.

On Friday morning, September 15, a symposium will be held on "The Joint Responsibilities of Science and the American Press in the Post-War Period," by the National Association of Science Writers.

Section and Society Programs are scheduled to be held as follows:

Section on Mathematics will meet Tuesday afternoon, September 12, when Dr. F. D. Murnaghan will deliver his retiring vice-presidential address on "The Teaching of Mathematics," and Dr. R. S. Burington will present a paper on "New Frontiers."

Section on Physics and the Ohio Section of The American Physical Society will hold four sessions on Monday and Tuesday at which 23 papers will be presented. At the close of the final session a sound and color motion picture film on "Crystals Go to War" will be exhibited. This film will illustrate the processes used in the production of quartz crystal units that are playing a major role in the war.

Section on Chemistry on Thursday afternoon, September 14, will present a symposium on "Catalysis," one of the papers being an address by Dr. Hugh S. Taylor, retiring vice-president of the association.

Section on Astronomy, on Thursday, September 14, will hold two sessions, the morning session consisting of general papers and the afternoon to a symposium on "Objective Prism Spectra."

Section on Geology and Geography will hold six sessions, September 12 to 14, inclusive, before which 50 papers will be presented, and field excursions.

The first session is Part I of the symposium on "Quartz," entitled "Geology and Mineralogy"; the second is Part II of the symposium, entitled, "Physics"; the third is on "Geography and Economic Geology"; the fourth is on "Stratigraphic and General Geology"; the fifth is on "Quaternary Geology of the Great Lakes Region"; and the sixth is on "Physiographic Geology and Meteorology." The field excursions on Friday will begin with a visit to an iron ore unloading dock, followed by visits to points of geological interest.

Section on Zoological Sciences will hold only a business meeting on Wednesday, the address of the retiring vice-president of the section, Dr. George T. Hargitt, being scheduled for delivery at the annual dinner of the American Society of Zoologists on Wednesday evening. The title of Dr. Hargitt's address is "What is Germ Plasm?"

American Society of Zoologists, on September 12 to 14, inclusive, will hold 11 sessions before which 58 papers and 12 demonstrations will be presented in person by their authors. In addition, 55 papers will be presented by title, a total of 125 papers. Of the papers to be read by the authors, 10 are in the field of "Cytology and Embryology," 10 on "Endocrinology," 9 on "Endocrinology and General Physiology," 13 on "General Physiology," 8 on "Morphology and Protozoology" and 8 on "Parasitology, General Evolution, and Ecology." The 57 to be read by title have a similar distribution. The society will hold its annual dinner on Wednesday evening, September 13.

American Society of Naturalists will hold its annual dinner on Thursday evening, September 14, at which Dr. Fay-Cooper Cole will deliver his presidential address on "Human Racial Development and Migration."

Section on the Botanical Sciences, on Tuesday afternoon, September 12, will hold a joint session with the Botanical Society of America, the American Phytopathological Society, the American Society of Plant Physiologists, and the Sullivant Moss Society, at which the program will consist of addresses of two past vice-presidents for the section and the current retiring vice-president.

Dr. G. M. Smith, Stanford University, vice-president for the section in 1942, will deliver his retiring address on "The Marine Algae of the Monterey Peninsula, California"; Dr. W. J. Robbins, New York Botanical Garden, vice-president for the section in 1943, will deliver his retiring address on "The Importance of Plants"; and Dr. R. E. Cleland, Indiana University, will deliver his retiring vice-presidential address on "Phylogenetic Relationships of Oenothera."

Botanical Society of America, September 12 to 14, inclusive, will present the programs of its 39th meeting in general sessions of the society and under four sections, the General Section, the Paleobotanical Section, the Physiological Section and the Systematic Section.

The General Section will hold three sessions, on Tuesday, Wednesday and Thursday mornings, at which 34 papers will be presented.

The Paleobotanical Section will hold a session on Tuesday morning at which 6 papers will be presented.

The Physiological Section will hold 5 sessions, two on Tuesday morning, one a joint meeting with the American Society of Plant Physiologists, at which 11 papers will be presented, and one jointly with the American Society of Plant Physiologists, at which 11 papers will be presented. On Thursday afternoon the section will hold a joint session with the American Society of Plant Physiologists, at which 8 papers will be presented.

The Systematic Section on Tuesday morning will hold a joint session with the American Society of Plant Taxonomists, at which 8 papers will be presented.

In addition to general sessions of the Botanical Society of America and its sections, and joint sessions with other societies, at which 93 papers will be presented, the society will participate in the symposium on "Nutrition" and the symposium on "Biology and Human Progress," mentioned above under "Special Symposia." It also joins in the Biologists' Smoker on Tuesday evening and sponsors the Botanists' dinner on Wednesday evening.

American Society of Plant Physiologists on September 12 to 14, inclusive, will hold 6 sessions and joint sessions at which a total of 50 papers will be presented.

On Tuesday morning two sections of the society will hold joint sessions with the American Society of Plant Physiologists and the Physiological Section of the Botanical Society of America. On Tuesday afternoon the society will hold a joint session with the American Society of Plant Physiologists. On Tuesday evening, the society will hold the Plant Physiologists' dinner, at which the Charles Reid Barnes Life Membership Award and the Stephen Hales Award will be announced. Following the dinner, Dr. W. E. Loomis, 1943 retiring president, will deliver an address on "Translocation in Maize."

On Wednesday morning and afternoon the society will hold joint sessions with the Physiological Section of the Botanical Society of America at which 21 papers will be presented. On Thursday morning the society will participate in the symposium on "Nutrition" and on Thursday afternoon will hold a joint session with the American Society of Plant Physiolo-

gists and the Physiological Section of the Botanical Society of America, at which 8 papers will be presented.

Mycological Society of America on Tuesday afternoon will hold a joint session with the American Society of Plant Physiologists and the Sullivant Moss Society. On Wednesday afternoon the society will hold its business session and a session at which Dr. G. W. Martin, president of the society, will deliver his presidential address on "The Classification of the Tremellales," which will be followed by 4 other papers. The society will also hold sessions on Thursday morning and afternoon at which 20 papers will be presented.

Sullivant Moss Society will hold a joint sesion on Tuesday afternoon with other societies, and sessions on Wednesday morning and afternoon at which 12 papers will be presented.

American Society of Naturalists will participate in the symposium on "Biology and Human Progress," on Thursday afternoon, and arrange for the Naturalists' Dinner on Thursday evening.

Ecological Society of America will meet on September 11 to 14, inclusive. It will hold its business session on Monday morning and a session Tuesday morning at which 3 papers will be presented. On Tuesday afternoon there will be 13 papers and reports on "The Study and Preservation of Nature." Following the dinner of the society on Tuesday evening, Dr. Orlando Park, past president of the society, will deliver an address on "Observations Concerning the Future of Ecology." On Wednesday morning a session will be held at which 4 papers will be presented. In the afternoon the society will divide into 3 sections, one for a conference on "Pollen Analysis and Related Bog Problems," another for an illustrated lecture on "The Native Forests of the Cleveland Region," and the third for a business meeting. On Thursday two sessions will be held, at which 11 papers will be presented, and a field trip to the beech-maple climax forest in North Chagrin Metropolitan Park.

The American Microscopical Society will hold a luncheon and scientific session on Tuesday, September 12.

National Association of Biology Teachers will hold its meeting on Saturday, September 16. In the morning and afternoon programs 7 papers will be presented. At its Saturday evening dinner, Dr. A. J. Carlson, the president of The American Association for the Advancement of Science, will deliver an address on "The Science of Biology and the Future of Man."

Union of Biological Societies will hold an important business meeting on Wednesday afternoon for the presentation of reports of committees and the consideration of the Union as a possible centralizing organization for American biologists.

Section on Anthropology will hold sessions on Friday afternoon, September 15, and on Saturday morning, September 16, for the presentation of papers. On the Friday afternoon session, at which 5 papers will be presented, there will be a "General Discussion on Race Problems." In the evening the Anthropologists' dinner will be held. The Saturday morning program consists of 5 papers.

Section on Psychology, on Monday and Tuesday, will hold joint sessions with the American Psychological Association and the American Association for Applied Psychology. On Tuesday evening the section will hold a joint session with the Section on Education, at which 2 addresses will be delivered. Dr. Edward C. Tolman, vice-president for the Section on Psychology, will deliver his retiring address on "A Stimulus—Expectancy Need—Cathexis Psychology," and Dr. Harold Clark, vice-president for the Section on Education, will deliver his vice-presidential address on "How Far is Experimentation in the Social Sciences Possible?"

American Psychological Association, American Association for Applied Psychology and Psychometric Society will hold sessions on Monday and Tuesday for the presentation of scientific papers. On Monday morning, in addition to the symposium on "Graduate and Professional Training of Psychologists," an address of the president of the American Association for Applied Psychology, Dr. Albert T. Poffenberger, will be delivered on "Psychology: Academic and Professional." At the same session, an address of the president of the American Psychological Association, Dr. Gardner Murphy, will be delivered on "The Freedom of Intelligence."

On Monday afternoon the societies will hold a conference on "The Problems and Values of the Proposed Reorganization of Psychological Studies." On Tuesday the societies will hold a symposium on "Psychology and Post-War Problems."

Section on Social and Economic Sciences will hold a session on Tuesday morning on "Geography and Population" at which 4 papers will be presented, one of which is the address of the retiring vice-president for the section, Dr. Stanley D. Dodge, whose subject is "Population Periods in the History of the United States."

American Statistical Association will hold a session on Monday morning, September 11, on the "Statistics of Biological Assay," at which 3 papers will be presented. The afternoon session will be devoted to a round-table discussion on "The Function of the Statistical Unit in a College, University, or Research Laboratory." The Wednesday morning program will be

on "Statistical Methods in Current Economic-Psychological Problems," while the afternoon will be devoted largely to technical statistical questions. On Thursday the society will hold two joint round-table conferences on "Forecasting Post-war Demand." Among the speakers at this conference will be Stephen M. DuBrul, General Motors Corporation; S. Morris Livingston, U. S. Department of Commerce; Jacob L. Mosak, Office of Price Administration, and Arthur Smithies, Bureau of the Budget.

Econometric Society will hold two general sessions on Wednesday, and on Thursday morning and afternoon it will hold a joint round-table conference with the American Statistical Association on "The Forecasting of Post-war Demand." On Friday morning the society will hold a session on "Consumption," and in the afternoon a final session on "Investment," at which Lawrence R. Klein, Massachusetts Institute of Technology, and Benjamin Higgins, McGill University, Montreal, will present papers.

Section on Engineering, on Tuesday morning and afternoon, will hold a symposium on "Synthetic Rubber," consisting of six papers. On Wednesday morning and afternoon the section will hold a symposium on "Aviation Medicine" jointly with the Section on the Medical Sciences. The contributors include Brigadier General Eugene G. Reinartz, Randolph Field, San Antonio, Texas; D. W. Bronk, Coordinator of Research, Office of the Air Surgeon, Army Air Forces; Hugh De Haven, Crash Injury Research Project, National Research Council; A. Sidney Harris, Western Reserve University; Ross A McFarland, Harvard University, and Franklyn D. Burger, Medical Officer, Northeast Airlines.

Section on Medical Sciences, on Tuesday morning, will hold a symposium on "Parasitology in Relation to the War" jointly with the American Society of Parasitologists and the American Society of Zoologists. On Wednesday the section will hold a symposium on "Aviation Medicine" jointly with the Section on Engineering. On Thursday morning the section will hold a session at which 11 papers will be presented, and on Thursday afternoon it will hold a symposium on "Premedical Education." At the two sessions on Friday 30 papers on a wide variety of subjects will be presented.

Subsection on Dentistry on Monday morning and afternoon will hold a symposium on "Fluorine and Dental Caries," at which 11 papers will be presented. Contributors to this important subject include H. Trendley Dean, F. L. McClure and F. A. Arnold, Jr., National Institute of Health; T. Ockerse, Department of Public Health, Pretoria, South Africa; Robert Weaver, Board of Education, London, England; Philip Jay, University of Michigan Dental School; Wallace D. Armstrong, University of Minnesota; Harold C. Hodge and R. F. Sognnaes, University of Rochester; Basil G. Bibby, Tufts Dental School, and Abel Wolman, the Johns Hopkins University.

Alpha Epsilon Delta, national honorary premedical fraternity, will hold a symposium on "Premedical Education," on Thursday afternoon, at which 5 papers will be presented.

Section on Agriculture on Thursday morning will hold a symposium on "Nutrition—Some Current Views" jointly with the Section on Botanical Sciences, the Botanical Society of America and the American Society of Plant Physiologists. The principal formal papers will be presented by R. E. Buchanan, Iowa State College; R. J. Garber, U. S. Regional Pasture Research Laboratory, State College, Pennsylvania, and A. E. Murneek, University of Missouri.

American Society for Horticultural Science will hold sessions on Tuesday, Wednesday and Thursday. On Tuesday morning the society will hold a joint session with American Society of Plant Physiologists on "Growth Substance." In the afternoon there will be two sessions, one on "Fruit Breeding" and one on "Vegetable Crops." The Wednesday morning program is in two sessions, one on "Pomology" and the other on "Vegetable Crops—Growth Substances." On Wednesday afternoon the society participates in the symposium on "International Collaboration in Science." The annual dinner will be held on Wednesday evening, at which the retiring president of the society, Dr. Warren P. Tufts, the University of California, will deliver an address. The programs on Thursday are on "Pomology," "Vegetable Crops" and "Tissue Analysis."

Sigma Delta Epsilon, Graduate Women's Scientific Fraternity, will hold its National Council meeting on Tuesday morning and a luncheon for all women in science on Wednesday noon.

American Society for Aesthetics will hold its first annual meeting on Monday, Tuesday, and on Wednesday morning. At the session on Monday morning 5 papers will be presented on "Aims and Methods in Aesthetics." The session on Monday afternoon will consist of a business session and papers on "General Theory." On Tuesday morning the general subjects will be "The Arts, Music, Literature," 5 papers, and 5 papers at the Tuesday afternoon session on "The Visual Arts." A dinner will be held on Tuesday evening. The Wednesday morning program will consist of 6 papers on "The Arts: Various Approaches."

Research Council on Problems of Alcohol will hold a symposium on alcoholism on Tuesday and Wednesday. The program on Tuesday morning consists of nine papers. The afternoon program consists of four general papers and a round-table session on "The Conditioned Reflex Treatment of Alcoholism." On Tuesday evening two concurrent round-table discus-

sions will he held, one on "Differential Diagnosis in Relation to Therapy" and the other on "Group Aids to Therapy (with Special Reference to Alcoholics Anonymous)." The Wednesday program will be devoted to "Alcoholism and War." Simultaneously the Committee on Alcoholics, Welfare Federation of Cleveland, will present a program of eight papers on various aspects of alcoholism.

AGAR RESOURCES OF THE SOUTH ATLANTIC AND EAST GULF COASTS

By HAROLD J. HUMM

MARINE LABORATORY, DUKE UNIVERSITY

North Carolina Resources

Commercial agar production on the Atlantic coast has become a reality during the past year with the processing by two firms of seaweed found in abundance along the North Carolina coast near Beaufort. Utilization of these newly discovered resources came as the result of a preliminary announcement made in Science[1] late in 1942 of work carried on in the Duke University Marine Laboratory. If the present abundance of raw material can be maintained, this new industry gives promise of continuing to thrive and expand after the war.

The most abundant red alga of the Beaufort region, *Gracilaria confervoides* (L.) Greville, is now being harvested, dried and sold by fishermen to processing factories. From 1,000 to 1,500 tons, wet weight, are estimated to have been gathered between August 1, 1943, and January 1, 1944. This is approximately 150,000 to 200,000 pounds of dry weed with an agar yield of 60,000 pounds or more, depending upon cleanliness of dry material, yield and thoroughness of extraction. Most of this seaweed was gathered from a single shallow bay of 500 to 600 acres in extent. Many other similar accumulations of Gracilaria were present from which no commercial collections were made.

In the Beaufort area, *Gracilaria confervoides* grows and accumulates in great loose masses in shallow water where salinity is almost that of the open sea. It is collected by simply forking it into small boats. Drying is accomplished by spreading it on racks covered with wire, slats or netting and built several feet above the ground. Dried material that has been carefully cleaned and bleached brings a higher price. Many fishermen are now selling fresh seaweed by the ton as one firm has recently omitted the drying step in processing.

Growth of this valuable seaweed occurs principally from May through November. Loose pieces, which may increase ten times in weight within two weeks, drift about, break apart and continue growth until areas protected from strong currents support masses of seaweed sometimes several feet thick. In late summer and fall, when commercial collecting is best, much of this accumulated material moves out of protected areas into deeper water where tidal currents distribute it throughout the sounds and winds wash it ashore. This drifting seaweed, formerly a net-fouling nuisance, is now collected commercially by shrimp trawlers. That which remains in protected areas continues to grow until about mid-November. Masses of it winter over and serve as "seed" material for the following summer's crop. In December, a slow deterioration begins, characterized by fragmentation of large plants, dying back and a slow decrease in agar yield. In some areas, an encrusting Bryozoan forms a layer of calcium carbonate over the stems. These loose plants apparently do not reproduce sexually, but scattered attached plants do so abundantly. The present abundance of Gracilaria may be coincident with the disappearance of eel grass, *Zostera marina* L. The latter probably occupied the habitats in which Gracilaria now accumulates and may have adversely affected for the alga such a factor as nitrate content of the sea water.

Agar made from *Gracilaria confervoides* of the Beaufort region, though not identical with that from Gelidium, the genus used for this purpose in California and Japan, is sufficiently similar to be referred to as agar. It seems to have somewhat greater gel strength and greater elasticity than Gelidium agar.

Gracilaria agar is more variable in temperature of gelation and usually somewhat higher than Gelidium agar. These variable results are not yet fully understood. Samples of Gracilaria agar produced by a factory located at Beaufort, N. C., have all gelled at about 38° C. Samples from another factory have exhibited a higher gelation temperature, some of these gelling at 55° C. or slightly higher. Raw material from which these agars were prepared came from the same general area at about the same time of year. The two methods of preparation were different. One process involved boiling, the other cooking under steam pressure; one product was purified by freezing, with the other this step was omitted. Variations in salt content and other impurities in agar have an influence

[1] H. J. Humm, Science, 96: 230–231, 1942.

upon temperature of gelation and other properties but these factors apparently do not account for the range of gelling temperatures observed in Gracilaria agar from North Carolina. This phenomenon has been attributed to the presence of a fraction of the Gracilaria extract with a high temperature of gelation present in the raw material. It may be a product of the manufacturing process. Because of this variation in gelling temperature and because Gracilaria agar from North Carolina exhibits somewhat greater syneresis as now produced, it is slightly less desirable than Gelidium agar for certain bacteriological uses.

The agar yield, in terms of percentage of the dry weight of the weed, varies from 25 to 45 per cent. Highest yields have been recorded from material collected in August. Some idea of the strength of this gel, as well as yield, can be had from a recent report (private communication) from Dr. John W. Gowen, professor of genetics at Iowa State College. He states that 250 to 300 grams of dry Gracilaria are sufficient to solidify 17 liters of corn-meal medium used for the cultivation of fruit-flies. Assuming a yield of 33 per cent., Gracilaria extract provides a satisfactory gel in this medium in a concentration of less than one per cent.

Gracilaria multipartita (Clemente) J. Agardh., common on shells and jetties along the North Carolina coast, though not of commercial abundance, produces agar of a quality and yield similar to that from *G. confervoides*.

Coastal Survey; Florida Resources

Between October, 1942, and April, 1943, a survey was made, sponsored by the War Production Board, of the Atlantic and Gulf coasts for additional agar-bearing seaweeds of possible commercial value. A search was made of coastal waters from the Eastern Shore of Maryland southward to Key West, Florida, then northward along the Gulf coast and westward to New Orleans. Water transportation, provided by the U. S. Coast Guard wherever requested, proved to be of great value in this work.

Although some agar-bearing seaweed resources were found in addition to those discussed above, the region from Beaufort to Atlantic, N. C., seems to be the most valuable yet discovered of the entire Atlantic coast.

Gracilaria confervoides grows in fair abundance on oyster beds in the general vicinity of Chincoteague Island, Va., and southward to Cape Charles. Here this species apparently grows 100 per cent. attached and is coarser in habit than that of the North Carolina coast. Considerable quantities are collected by oystermen in their dredges, but up to the present, the seaweed is discarded as of no value.

Between Swansboro, N. C., and Jacksonville, Fla., agar-bearing seaweeds were not encountered in commercial abundance. However, Mr. G. Robert Lunz of the Charleston Museum, Charleston, S. C., recalled (private communication) that many tons of Gracilaria were washed in along the James Island shore of Charleston harbor in 1932 and 1934. Possibly transplantation would restore this region to its former productiveness. In the Indian River along the east coast of Florida considerable quantities of Gracilaria were seen but it was not believed at that time that its abundance was sufficient to provide a factory with adequate raw material. Scientists of the Institutum Divi Thomae, working at their Palm Beach laboratory, had discovered Gracilaria in the Indian River previous to the survey reported here. Commercial production from these resources is now in progress.

From Palm Beach southward to Homestead, Fla., agar-bearing seaweeds do not reach an abundance of economic value. *Gracilaria multipartita* is fairly common, however, in Biscayne Bay at Miami.

Along the Overseas highway between Miami and Key West, three species, *Gracilaria cervicornis* (Turner) J. Agardh., *Hypnea musciformis* (Wulfen) Lamouroux and *Eucheuma isiforme* (C. Agardh.) J. Agardh., from which an agar-like substance was obtained, occur in moderate abundance. The extracts from these are here referred to as gelose because they form a weaker gel than agar and one which differs from agar in other properties. They occur mostly mixed with other algae of no economic importance. Commercial utilization may not be profitable, although it is possible that much greater quantities than were seen along the highway may occur among adjacent islands. *G. cervicornis* produces a gelose similar to that from Irish moss (*Chondrus crispus* (L.) Stackhouse) of New England but has a substantially greater gel strength. Gelose from Hypnea sets to a firm gel but its behavior is rather anomalous and unreliable; that from Eucheuma, though softer than agar, is remarkably elastic and tough. With Eucheuma extract, gelation begins at 75° or 80° C. This is probably the gelose referred to by I. A. Field[2] as having been extracted from an unidentified alga collected near Key West.

Florida's seaweed resources of commercial abundance are located along the lower west coast from Cape Sable northward through Tampa Bay. During the winter of 1942–43, and again in 1943–44, thousands of tons of several species of Gracilaria, *Hypnea musciformis*, and *Agardhiella tenera* (J. Agardh.) Schmitz were present in these waters. The more abundant species of Gracilaria were *G. blodgettii* Harvey, *G. armata* (Agardh.) J. Agardh.,[3] and *G.*

[2] I. A. Field, *Chem. Age*, 29: 485–486, 1921.

[3] Because of the inherent taxonomic difficulty of the genus Gracilaria and its need for study and revision, some of these identifications must be considered tentative.

cornea J. Agardh. Less abundant but nevertheless present in large quantity were *G. multipartita,* and *G. caudata* J. Agardh. The more abundant species of Gracilaria of this region yield gelose of lower gel strength than the average sample of commercial agar; the less abundant species yield agar similar in gel strength or only slightly inferior in this respect to commercial agar. *Digenea simplex* (Wulfen) C. Agardh., abundant north of Tampa Bay especially near Tarpon Springs, produces an agar of high gel strength, but apparently the yield is too low to make the species commercially valuable.

Table 1 constitutes a list of agar or gelose-bearing red algae present in abundance along the Florida west coast in winter, together with their dry weights recorded as a fraction of the wet weight.

TABLE 1

DRY WEIGHTS EXPRESSED AS FRACTION OF WET WEIGHT	
Gracilaria blodgettii	1/14
Gracilaria armata	1/15
Gracilaria caudata	1/6
Gracilaria multipartita	1/9
Gracilaria cornea	1/10
Hypnea musciformis	1/12
Agardhiella tenera	1/16
Eucheuma isiforme	1/7
Digenea simplex	1/7

Relative to the above table, it should be noted that from 85 to 95 pounds of water are evaporated in drying down 100 pounds of fresh seaweed. Assuming cell sap to be isotonic with sea water, a residue of salt of approximately three pounds would remain. This is largely removed only if the material is washed thoroughly after the first drying. Figures in Table 1 were obtained from seaweed washed well in fresh water soon after collection so that most of the salt content of the cells is included in the dry weight. These figures, although approximations, are of value in making calculations of total agar yield per ton of fresh seaweed and thus in determining value of raw material.

In Table 2 are averages of agar or gelose yield and the highest yield recorded for each species listed.

TABLE 2

YIELD, IN AGAR OR GELOSE, EXPRESSED AS PER CENT. OF DRY WEIGHT

	Average Yield	*Highest Yield*
Gracilaria blodgettii	55	66
Gracilaria armata	56	73
Gracilaria caudata	60	70
Gracilaria multipartita	44	50
Gracilaria cornea	67	72
Hypnea musciformis	53	57
Agardhiella tenera	55	61

In making extractions from which values in Table 2 are taken, usually 20 grams, oven-dry weight at 50° C. were added to 500 cc tap water. This was autoclaved at 15 pounds pressure for one-half hour, the liquid poured off, allowed to gel, then dried down to constant weight at 50° C. From 300 to 500 cc of water were then added to the seaweed residue and autoclaving repeated. Again the solution was poured off and dried. Usually a third such extraction was made, sometimes a fourth. The seaweed residue was saved and dried as a check. A few extractions were made by boiling in an open vessel. Twenty grams of dry *Gracilaria blodgettii,* ground to powder in a laboratory mill, were added to one liter of boiling water. Three-fourths or more of the calculated gelose content went into solution within ten minutes. Studies on yield, rate of extraction and quality of agar or gelose included various extraction methods, lengths of time, volumes of water in proportion to dry seaweed, effect of pH, autoclaving versus boiling, whole versus pulverized and dry versus fresh material. Consideration of these factors is still in progress, the results of which will be presented in a later report.

It may be said at this time that only a superficial study has yet been made of the nature of the gelose derived from these seaweeds. For many of these species, this is apparently the first time they have been considered as possible sources of agar. Each extractive deserves detailed study of physical and chemical properties so that uses to which it is best suited may be found. Tests were made on approximate relative strength of gels from each species, using one or more samples of commercial agar as standards.

Gracilaria multipartita produces agar with a gel strength equal to or exceeding Gelidium agar. *Gracilaria caudata* seems to be from 75 to 100 per cent. that of Gelidium agar. The gels from *G. blodgettii* and *G. armata* seem to have a strength ranging from 50 to 75 per cent. that of the standards. *G. cervicornis* is similar to these. *G. cornea* yields an extract having the lowest gel strength of any member of this genus studied. However, the viscosity of the melted solution is much higher at all temperatures than that of any other species tested. *Agardhiella tenera* yields a gelose that scarcely forms a rigid gel. Even in two per cent. solution the extract is a viscous liquid with only a suggestion of gelation. It is cold-water-soluble.

Some of the seaweed extracts discussed here seem to be composed of two or more fractions that are difficult to separate. Probably the difference lies in the nature of the carbohydrate part of the gelose micelle as has been shown[4] to be the case with the extract of *Chondrus crispus.* Physical and chemical studies may lead to methods of fractionation, greater purification, a greater variety of geloses and an accompanying increase in their uses and value. Furthermore, it may be possible to alter characteristics of a given extract to meet certain food or industrial requirements.

[4] T. Dillon and P. O'Colla, *Nature,* 145: 749, 1940.

Most of the studies on species found along the west coast of Florida were done between January 15 and March 15, 1943, in the new laboratories of Citrus Concentrates, Inc., at Dunedin, Fla. Valuable assistance was given by Mr. Harold Marston, an employee of the company.

OBITUARY

NORTON ADAMS KENT

NORTON ADAMS KENT, for many years professor of physics at Boston University, died on June 5, 1944, at Chocorua, New Hampshire, near the end of his seventy-first year, and just after completing a busy year of academic work.

He was the founder of the physics department at Boston University and for a considerable time he constituted the entire department, a situation which for most men would have ruled out any possible opportunity for research. Yet he continued to publish papers in spectroscopy along with his other duties so that a former head of the physics department of the Masachusetts Institute of Technology about twenty years ago remarked, "There is more scientific spirit in that little physics department at Boston University than there is here at the Institute!"

Professor Kent was born on July 28, 1873, in New York City. His parents were Elmore Albert and Mary Abbie (Holman) Kent. He received his bachelor's degree from Yale in 1895 and spent further time in graduate study there. Then he attended Johns Hopkins University from 1898 to 1901 where he studied under Henry A. Rowland and at the same time associated with some of the foremost men in the American scientific world. These connections he maintained to the end of his life. After obtaining his Ph.D. in 1901 he spent two years as assistant at the Yerkes Observatory in Wisconsin, then he received a professorship at Wabash College, Indiana, where he taught physics until 1906.

In March, 1906, he married Margaret Crowninshield, of Salem, Mass. He is survived by Mrs. Kent and one daughter, Margaret Crowninshield Kent.

In 1906 Dr. Kent undertook to establish a physics department at Boston University which hitherto had sent its students to the Massachusetts Institute of Technology for this part of their training. At that time the university was not over-supplied with funds, so that Dr. Kent found himself raising money not only for the partial equipment of the laboratory but also for his own research projects. He served Boston University for four years as assistant professor and thirty-two years as full professor. He was professor emeritus beginning June, 1942. At this time Dr. Kent also became visiting professor of physics at the Massachusetts Institute of Technology.

He was a member of Phi Beta Kappa, Sigma Xi, the American Association for the Advancement of Science and the American Physical Society. He was a fellow of the American Academy of Arts and Sciences and chairman of its Rumford Committee.

His special field was spectroscopy, and between 1901 and 1939 he published nineteen papers on such subjects as the Zeeman effect, shifts of spark lines due to circuit conditions, fine structure of spectral lines as determined by the echelon, also by Lummer plates, both crossed and in tandem, and determination of wave-lengths. He spent his first sabbatical leave of absence from Boston University in Germany, working in collaboration with Paschen on the Zeeman effect of five lithium lines. His second sabbatical year was spent at the California Institute of Technology with Houston, photographing the hydrogen molecular spectrum and measuring its wave-lengths. One can imagine his emotional reaction when several years later he surveyed Harrison's beautiful recording spectrophotometer which will measure in a few seconds plates such as Dr. Kent had labored over for many months. At the time of his death he was working on the fine structure of H α on which subject he had already published three papers.

While he seized every opportunity for research, he did not neglect his university duties. He was an efficient teacher with a passion for accuracy of statement. He was a wise counselor and a conscientious administrator. Instrumental in obtaining the establishment of the Wadsworth Student Loan Fund, he administered it faithfully until his retirement. He was particularly interested in students of foreign birth, and was very active in a local committee organized to promote friendly relations among such students. He will be long remembered by his students and colleagues alike as a man of tireless energy and thoroughly altruistic nature.

ROYAL M. FRYE
LUCIEN B. TAYLOR

SCIENTIFIC EVENTS

INDUSTRY AND RESEARCH IN GREAT BRITAIN

A STATEMENT in regard to scientific and industrial research has been issued by ninety-two prominent British leaders of industry, science and university teaching. It gives arguments in regard to the importance of scientific research and for the need for a great expansion of research facilities of all kinds. It presents, according to an editorial in *The Times*, London, a well-reasoned discussion of the parts to be played

respectively by individual firms, industrial research associations, government research stations, technical colleges and universities. It gives rise to many original suggestions, some of them not free from controversy. Apart from research undertaken by individual firms, the report calls upon industrialists collectively to aim at maintaining some twenty-five research associations which would employ between them four or five thousand scientists and technicians and would cost about £4,000,000 a year in running expenditure, to which should be added £2,000,000 or £3,000,000 for development work. This demand is reasonable and moderate and it is a matter for regret that the past attitude of the majority of industrial firms has driven the signatories to conclude that it may not be possible to set research associations properly on their feet without compelling each firm in an industry to make its financial contribution to the appropriate association.

The report rightly insists that lack of facilities for experimental development is still the most serious shortcoming to be remedied if the time-lag between scientific discovery and practical application is to be reduced. It makes a suggestion which requires serious attention—that a state development fund should be created to subsidize experimental work of potential public benefit. The government is also called upon to assume greater direct responsibility for research, to be constantly on the watch for new scientific ideas which may have social or economic value, and, where necessary, to take the initiative in trying them. Most important is the further proposal, of which little has been heard in recent discussions, that the government should, on behalf of the consuming public, arm itself with all powers needed to review industrial costs and margins and, where desirable, to promote standardization of the types and qualities of products in order to ensure that the consumer gets the full benefit of the application of science to industrial processes. It is good, too, that the statement lays stress on the practical importance of the much neglected biological sciences, and that it is well aware of the danger of too exclusive a concentration upon physical and chemical research to the neglect of social, economic, psychological and management studies, all of which, as the report says, are of no less importance to the well-being of the community than industrial research in the narrow sense.

BEIT MEMORIAL FELLOWSHIPS FOR MEDICAL RESEARCH

SIR THOMAS LEWIS, F.R.S., has been appointed to succeed Profesor T. R. Elliott, F.R.S., on the Board of Trustees of the Beit Memorial Fellowships for Medical Research, and Dr. A. N. Drury, F.R.S., has been appointed acting secretary.

The following fellows have been elected with permission for each fellow to be seconded at any time for war duties:

W. HOLMES, D.PHIL. To continue the study of the regeneration of nerve-fibers after injury. At the department of zoology and comparative anatomy, University Museum, Oxford.

MARY F. LOCKETT, M.D. To continue the study of renal pressor substances responsible for experimental high blood pressure. At the Laboratory of Pharmacology, Cambridge.

J. C. BOURSNELL, PH.D. To study the fate and functions of trace and some other elements in the animal body, using radio-active isotopes. At the department of biochemistry and chemistry, of the Medical College, St. Bartholomew's Hospital.

G. A. LEVVY, D.SC. To study the adaptive enzymes in the animal body with special reference to the rôle of glucuronidase in the metabolism of steroid hormones and related substances. At the department of medical chemistry, University of Edinburgh.

H. J. ROGERS, PH.D. To study the biochemistry of hyaluronidase, and the rôle of such enzymes and other bacterial antigens in infection. At the Lister Institute, Elstree, Herts.

G. J. ROMANES, PH.D. To study the relationship between the developing mesoderm and the motor apparatus of the spinal cord supplying it. At the department of anatomy, University of Cambridge.

F. SANGER, PH.D. To study the chemical structure of proteins with special reference to insulin. At the Sir William Dunn Institute of Biochemistry, Cambridge.

S. P. V. SHERLOCK. To study the hepatic function in disease by biopsy methods. At the department of medicine, British Postgraduate Medical School, London.

C. WAYMOUTH, PH.D. To study the factors influencing tissue growth *in vitro*. At the department of physiology, University of Aberdeen.

E. C. WEBB. To study the ultimate mode of action of drugs and poisons in living tissues. At the Sir William Dunn Institute of Biochemistry, Cambridge.

TWENTY-FIVE YEARS OF BOTANY AT BUTLER UNIVERSITY

IN connection with a banquet on September 15 to celebrate the twenty-fifth anniversary of the department of botany of Butler University, the following account of its work has been sent to SCIENCE by Dr. John E. Potzger, associate professor of botany in the department:

A quarter century has passed since Dr. Ray C. Friesner joined the faculty of the department of biology at Butler University, and there offered the first course in botany. One year later (1920) it was divided into a department of botany and a department of zoology.

The first courses in botany had an enrollment of 43 students. During the peak in the first semester of 1941 the enrollment reached 304. Beginning with an offering of 15 credit hours (3 courses), the department expanded until at present it offers 107 credit hours (25 different courses). During the quarter century, 130 Butler students majored in botany; of these 49 now hold M.A., and 19 Ph.D. degrees. Eighteen teach in colleges and universities, 18 hold membership in Sigma Xi.

The department has at present three full-time professors, and two instructors in the evening division. Each

member of the regular staff pursues some field of research. Ray C. Friesner's interests are in the taxonomy of Indiana plants, the goldenrods of North America, and dendrology; C. M. Palmer specializes in algae, with emphasis on Lemanea, and J. E. Potzger works in phytosociology, grasses of Indiana and pollen analysis. Collaborating in departmental research are Wm. Daily, of the Eli Lilly Laboratories, in Cyanophyceae, and Mrs. Wm. Daily in Characeae.

In 1919 Butler had no herbarium, to-day it is possessor of 70,000 sheets of ferns and higher plants, 1,600 algae and 1,000 packets of mosses. These represent collections by members and students of the department, or exchanges for collections made by the staff. The department sent out 39,220 sheets to herbaria all over the world, and received 23,220 sheets. The Botanical Library receives 240 current magazines.

In 1928 the Butler Botanical Garden was founded, and in 1929 the department began publication of the "Butler University Botanical Studies." They are gradually becoming a valuable source for ecological studies of Indiana forests. Members of the staff and majors in the department make a sociological study of every larger tract of comparatively undisturbed timber in Indiana that is brought to their attention. The Butler Studies reach 167 universities all over the world. To date the members of the staff and graduate students have contributed 160 scientific articles.

THE ANNUAL MEETING OF THE OPTICAL SOCIETY OF AMERICA

THE twenty-ninth annual meeting of the Optical Society of America will be held at the Hotel Pennsylvania, New York, N. Y., on October 20 and 21.

On the morning of Friday, October 20, there will be a symposium of invited papers entitled "A Review of Some Applications of Optics." The papers included are "The Projection of Light," by Frank Benford; "Practical Applications of Metallic and Non-Metallic Films on Optical Elements," by Dean A. Lyon; "Photography of the Ocean Bottom," by Maurice Ewing, "Techniques in Applied Electron Microscopy," by Robert D. Heidenreich. Following luncheon on the same day Professor Richard M. Sutton will present a brief report of the recent National Research Council Conference on Present and Postwar Problems Facing Physicists. In the afternoon a continuation of the symposium of invited papers is planned. The program includes "Recent Studies on the Fluorescence of Glass," by N. J. Kreidl; "Color Motion Pictures of the Whole Sky," by H. R. Condit; "The Application of Spectro-Chemical Analysis in the Steel Mill," by P. R. Irish. The speaker at the dinner will be Professor R. W. Wood, professor of physics at the Johns Hopkins University, who will present some "Reminiscences." Prior to his address the Adolph Lomb Medal for 1944 will be presented to Dr. R. Clark Jones, of the department of physical research of the Bell Telephone Laboratories. On Saturday, October 21, both morning and afternoon, there will be sessions for contributed papers.

All members intending to present papers at the sessions on Saturday are urged to submit abstracts as soon as possible and not later than September 12 in order that proper clearance may be obtained from the authorized Government agencies. Members of the Armed Forces and representatives of Government agencies should obtain clearance for their own abstracts, forwarding a copy of the authorization to the secretary with the abstract. Should a large number of contributed papers on spectroscopy be received, arrangements will be made for simultaneous sessions on Saturday.

Train and hotel reservations should be made early. The meeting will be open to non-members as well as members of the society and all those interested are cordially invited to attend. Non-members who desire to receive the advance program or other information in regard to the meeting should address their requests to Arthur C. Hardy, Secretary, Optical Society of America, Massachusetts Institute of Technology, Cambridge 39, Mass.

SCIENTIFIC NOTES AND NEWS

PROFESSOR S. A. MITCHELL, who is retiring after serving for thirty years as director of the McCormick Observatory of the University of Virginia, has been presented by colleagues, former students and friends with an album containing a hundred and twenty-six letters of appreciation.

PROFESSOR SOLOMON LEFSCHETZ, of Princeton University, has been elected an honorary member of the Mexican Mathematical Society.

LIEUTENANT COLONEL GARFIELD GEORGE DUNCAN, M.C., has been awarded the Legion of Merit for his "outstanding experimental work on the suppressive treatment of malaria in the Southwest Pacific area."

THE Bisset Hawkins Medal of the Royal College of Physicians, London, has been awarded to Brigadier J. A. Sinton, in recognition of his work on preventive medicine, particularly on malaria.

SIR JOHN MARSHALL, from 1902 to 1931 director-general of archeology in India, has been awarded the Gold Medal of the Royal Asiatic Society.

THE Royal Astronomical Society of Canada has conferred the Chant Medal for 1943 on Cyril Geoffrey

Wates, of Edmonton, Canada. The medal is awarded to an amateur astronomer resident in Canada, "on the basis of the value of the work which he has carried out in astronomy and closely allied fields of original investigation."

THE Vega Medal of the Swedish Anthropological and Geographical Society has been awarded to Professor Lennart von Post, of Stockholm, in recognition of his contributions to the development and application of the methods of pollen analysis.

COMMANDER GEORGE C. PAFFENBARGER, of the Dental Corps of the U. S. Navy, was awarded the honorary degree of doctor of science at the graduation exercises on September 1 of the Ohio State University.

WALDO L. SEMON, of the B. F. Goodrich Company, has been elected by the Goodyear lecture committee of the Division of Rubber Chemistry of the American Chemical Society the Goodyear Lecturer for 1944 in recognition of "his outstanding contributions in the chemistry and technology of rubber." It is expected that the lecture will be given next year at the spring meeting, as the meeting of the division that was planned for this autumn has been cancelled.

A UNITED PRESS dispatch from Paris dated August 28 reads "Dr. Pasteur Vallery-Radot, the new French Minister of Health, said to-day that he had dismissed Dr. Alexis Carrel from his post and intends to modify 'deeply' the Carrel Institute in Paris. The minister said the dismissal was one of his first actions of necessary 'purification.'" A later dispatch, dated August 31, states that Dr. Carrel has been arrested on the ground that the Carrel Institute has been "founded for the purpose of supplanting the great French universities and introducing Fascism and Marxism to students."

TWENTY-SEVEN associates and nineteen members were initiated into the Stanford University Chapter of the Society of the Sigma Xi at the annual dinner held on June 9. Professor G. Szegö, of the department of mathematics, gave the address of the evening. He spoke on "Scientific Research in European Universities." During the year the chapter sponsored lectures by C. E. Kenneth Mees, director of research and development of the Eastman Kodak Company; by Dr. H. F. Mark, professor of organic chemistry at the Polytechnic Institute of Brooklyn; by Dr. Selig Hecht, professor of biophysics at Columbia University; by Dr. A. J. Carlson, emeritus professor of physiology at the University of Chicago, president of the American Association for the Advancement of Science, and by Karl K. Darrow, physicist of the Bell Telephone Laboratories, national secretary of the American Physical Society. The following have been elected officers for the coming year: *President,* Professor G. S. Parks, chemistry; *Vice-president,* Professor O. C. Shepard, mining engineering; *Secretary-Treasurer,* Professor H. M. Bacon, mathematics; *Assistant Secretary-Treasurer,* Professor W. H. Johnson, biology.

THE Chapter of the Society of the Sigma Xi of the University of Southern California has elected officers for 1944–45 as follows: *President,* Dr. Arthur W. Nye, professor of physics; *Vice-president,* Dr. Howard de Forest, professor of botany; *Secretary,* Dr. Winslow Whitney Smith, associate professor of bacteriology; *Treasurer,* Dr. Robert Rutherford, associate professor of histology and pathology (dentistry). At the installation meeting on May 15, ten persons were elected to membership and thirteen to associate membership. Following the meeting, the spring public lecture was presented by Dr. A. J. Carlson, who spoke on "Nutrition."

MEMBERS of the National Committee for Mental Hygiene have been elected as follows: Dr. Thomas Parran, Surgeon General of the U. S. Public Health Service; Senator Elbert D. Thomas, of Utah; Dr. Frank Fremont-Smith, medical director of the Josiah Macy Jr. Foundation; Dr. Robert P. Knight, of the Menninger Clinic, Topeka, Kans., and Captain Forrest M. Harrison, a senior psychiatrist in the Navy Medical Corps and chief of neuropsychiatry of the Naval Hospital at Bethesda, Md.

DR. C. OTTO ROSENDAHL, professor of botany at the University of Minnesota and for twenty-one years chairman of the department, has retired with the title professor emeritus. He joined the faculty as an instructor in 1901. He will continue his researches on the flora of the state in the herbarium of the University of Minnesota.

DR. HERBERT INSLEY, senior petrographer of the National Bureau of Standards, has been appointed professor of petrography and head of the department of earth sciences at the Pennsylvania State College.

DR. CARROLL B. NASH has been appointed assistant professor of biology at the American University, Washington, D. C.

DR. WILLIAM A. FITZGERALD, for sixteen years librarian and archivist of the Brooklyn Preparatory School, N. Y., has been appointed librarian of the School of Medicine and assistant professor of medical history at St. Louis University.

A DIVISION OF ACOUSTICAL RESEARCH to investigate air-borne sounds has been established in the College of Engineering of Rutgers University under the direction of Dr. Carl F. Eyring, professor of physics at Brigham Young University. Work will be done under contract with the Office of Scientific Research and Development.

DR. PAUL D. STURKIE, of the Alabama Polytechnic Institute, has been appointed associate professor of

poultry husbandry at the New Jersey College of Agriculture, Rutgers University.

DR. E. E. TURNER, of Bedford College, University of London, has been appointed professor of chemistry.

DR. J. A. SALZMANN, head of the Dental Service of the New York City Vocational Schools, recently gave a series of lectures and clinics before the Asociacion Dental Mexicana and also the Asociacion Mexicana de Orthodoncia, Mexico, D. F., and before the Sociedad de Orthodoncia de Guadalajara.

DR. CLARENCE COTTAM, biologist of the Fish and Wildlife Service, has been appointed to the newly established position of assistant to the director. Since 1934 he has been in charge of a section devoted to research on economic wildlife problems for the service. In this position, he will serve as coordinating and liaison officer for the service in the field of wildlife conservation and management in connection with other land-use agencies, particularly with the Bureau of Reclamation, the Army Engineers of the War Department, the Tennessee Valley Authority and other Federal and State agencies. His headquarters will remain in Chicago, Ill., at the Central Office of the service.

DR. EMMELINE MOORE, who recently retired as chief aquatic biologist and director of the Biological Survey for the New York State Conservation Department, has become research assistant in the Bingham Oceanographic Laboratory at Yale University for the academic year 1944–1945. She is engaged in work on the program involving studies on the utilization of marine resources undertaken by this laboratory in cooperation with the Connecticut State Board of Fisheries and Game and the Woods Hole Oceanographic Institution.

MAJOR JOHN C. SWARTZWELDER, assistant professor of parasitology at the School of Medicine of the Louisiana State University, has returned from sixteen months' service with the Army Medical Corps in the South Pacific. He has been assigned to the Surgeon General's Office in Washington, D. C.

DR. ANN G. KUTTNER, lecturer in bacteriology at the Harvard Medical School, has been appointed bacteriologist of the Mary Imogene Bassett Hospital in Cooperstown, N. Y.; Dr. Halvor N. Christensen, instructor in biological chemistry, has been appointed biochemist.

PROFESSOR H. RAISTRICK, F.R.S., professor of biochemistry at the London School of Hygiene and Tropical Medicine of the University of London, has been designated honorary scientific adviser on penicillin production to the British Ministry of Supply. Professor Raistrick is a member of the General Penicillin Committee.

PROFESSOR J. L. SIMONSEN, director of research of the British Colonial Products Research Council, and Professor Sir Robert Robinson, Waynflete professor of chemistry at the University of Oxford and a member of the council, are now on a visit to the Caribbean area where they are discussing fundamental problems of research on new uses for colonial raw materials, with specific reference to the coordination of the work of the Colonial Products Research Council with that of the Caribbean Research Council. The latter was created last year to provide the Anglo-American Caribbean Commission with technical and scientific advice on matters concerning the social and economic advancement of the Caribbean peoples.

THE annual clinical congress of the American College of Surgeons, that was planned to be held in Chicago from October 24 to 27, has been canceled because of the war-time transportation situation.

THE American Association of Textile Chemists and Colorists will resume its annual meetings with a three-day program to be held at Atlantic City from October 12 to 14.

THE National Industrial Chemical Conference will be held from November 15 to 19 in conjunction with the third biennial National Chemical Exposition at the Coliseum in Chicago. Arrangements are being made for a number of educational exhibits.

THE British Colonial Office announces that the Secretary of State for the Colonies has decided to institute a number of Colonial Research Fellowships, open to university graduates in the natural or the social sciences, for research work in the Colonial Empire. The fellowships will be awarded by the Secretary of State on the advice of the Colonial Research Committee. They will normally be reserved for university graduates under thirty-five years of age with experience in research and giving evidence of high ability. The fellowships will be tenable for two years or possibly three if the work of the first year is satisfactory. They will carry a basic allowance of £400 per annum, which may be increased to £600 if the fellow is married; travelling expenses will also be paid. The fellowships will be tenable in any part of the British Colonial Empire. Fellows may be attached to centers of higher education in the colonies and required to give occasional lectures. The fellow will be responsible to a supervisor, through whom he will submit a concise progress report yearly and a full report on completion of tenure.

A HUMAN Nutrition Research Unit has been established by the British Medical Research Council, with Dr. B. S. Platt as director. The unit is already engaged in important investigations affecting colonial nutrition, and is offering hospitality for study and research to nutrition workers from the colonies. It

will also be ready to advise Colonial Governments on technical questions. Its formation is regarded only as a first step towards a wider organization which, it is hoped, will include both teaching and research in its scope, and will cooperate closely with workers in the Colonial Dependencies.

DISCUSSION

FREEDOM IN SCIENCE

IN conversation with scientific colleagues in this university, I have heard the opinions expressed that the American Association for the Advancement of Science could fulfill in the United States the functions of the British Society for Freedom in Science and that the vigorous opposition recently shown to the Kilgore Bill by scientific organizations is an indication of the support that the ideals of this society would receive in this country. On the former question, of course, nothing can be said until the association itself goes on record either for or against, but it is the conviction of the writer that the second opinion is unduly and perhaps dangerously complacent.

It seems reasonable that the article by Professor P. W. Bridgman[1] on the British Society for Freedom in Science expresses a point of view likely to receive more support in this country than in Great Britain, where the general tendency towards socialization has been developed and extended more fully. Necessary as such a development may be in twentieth century political economy, it is clearly dangerous to attempt to extend it to cover every phase of human activity. The only question that an investigator should ask is "Is it true?" and the question "Is it socially useful?" is irrelevant to science.

Because of a resentment towards social controls over the advancement of science many persons engaged in pure or academic research are in agreement with Dr. Vannevar Bush[2] when he says: "(Any government) support (of pure science) should be divorced from governmental control of the scientists and laboratories themselves, or it will stifle rather than expedite their true accomplishments." This statement was made in connection with the Kilgore Bill. But while opposed to the Kilgore Bill on the grounds of too great externally applied control of science, pure scientists found themselves in the company of others who were opposed to it for reasons totally different: whose freely admitted motives are "public good and corporation profit."[3] Neither of these motives, important as they are, is primary with the pure scientist and consequently, sooner or later, he will be in opposition to those with whom he was previously allied against this bill. He can, therefore, take no comfort from the opposition shown to the Kilgore Bill: he was not responsible for its vigor. The fact that the membership of the British Society for Freedom in Science is only 134, after three years of existence, shows how pitifully few he can muster in his support.

Almost the first schism that one can foresee between pure scientists and scientists who rely on private industry for their livelihood is likely to be on the question of whether or not the Government should be encouraged to spend greatly increased sums of money for the support of research. The negative attitude of industry towards Government sponsored research has been pointed out quite clearly on page 147 of Bernal's book, "The Social Function of Science" (Macmillan, 1939). In the original Kilgore Bill[4] the sum of two hundred million dollars is appropriated to carry out the purposes of the act. Solely from the point of view of the advancement of human knowledge it is highly desirable that this sum of money, or even greater sums, be spent on scientific research, both pure and applied. While opposed to the terms of the Kilgore Bill for the administration of this money, most pure scientists would yet encourage the scientific advance that its expenditure would create. Nevertheless the opponents of the bill that have so far been heard are in favor of its total rejection rather than of some constructive counter-proposals for the administration of the money.

These general remarks are intended to point out to persons engaged in academic research that the opposition expressed by men of science to the terms of the Kilgore Bill is not necessarily a sign of wide-spread public sympathy with the ideals of the British Society for Freedom in Science.

SYDNEY ROSS

STANFORD UNIVERSITY,
CALIFORNIA

AN article by Dr. P. W. Bridgman in the issue of SCIENCE for July 21, 1944, considers the need for support in the United States of the British Society for Freedom in Science. In his introduction to a statement by the founders of the British Society, Dr. Bridgman notes that in the United States there exists to-day a growing tendency toward "totalization" of science and that there is a need for support of a society dedicated to combating this trend. The state-

[1] SCIENCE, July 21, 1944.
[2] SCIENCE, 98: 2557, 577, 1943.
[3] SCIENCE, 97: 2529, 554, 1943.
[4] SCIENCE, 97: 2523, 407, 1943.

ment of the British Society for Freedom in Science, embodied in Dr. Bridgman's article, states that "J. D. Bernal's book, 'The Social Function of Science,' became a keystone of the movement against free science." It is said further that "the Association of Scientific Workers adopted the movement as a part of its policy, and has worked energetically on its behalf ever since, both privately and in public."

As a founding member and past vice-president of the American Association of Scientific Workers (A.A.Sc.W.), I am much interested in the reference to the British Association of Scientific Workers. It is not my intention to enter into the merits of the British controversy, though, to put it midly, it seems unfair to portray the British Association of Scientific Workers as the enemy of all free science. I shall, however, appreciate an opportunity to explain what, to me as an individual, seems to be the place of the American Association of Scientific Workers in this debate. While friendly to the British Association of Scientific Workers, the American Association of Scientific Workers is a wholly independent organization.

No one who has witnessed the developments of the past decade can deny that research in applied science, dedicated to the solution of specific problems affecting human welfare, will have a prominent place in the postwar organization of scientific research. It is inevitable, and probably not to be deplored, that in future years planning and cooperation in science will become increasingly important. The first article of the aims of the American Association of Scientific Workers states unequivocally that the organization will support developments along these lines. This does not, however, imply that the American Association of Scientific Workers will favor, desire or tolerate the suppression of pure research. If there are members of the American Association of Scientific Workers who hold such views, I am unaware of their existence. The fourth article of the aims of the American Association of Scientific Workers states that the organization is dedicated to "safeguarding the intellectual freedom and professional interests of scientists."

Dr. Bridgman's introductory paragraph refers to the original Kilgore Bill. An official pronouncement on this bill by the American Association of Scientific Workers was made by the Boston-Cambridge Branch, which issued a three-fold report on this controversial but highly important bill. After discussion of the Kilgore Bill by the membership, three subcommittees were appointed, one composed of members favoring the bill, another of those favoring the bill with certain definite modifications, the third of those opposing the bill. Each committee prepared its report, and the three reports together were then released publicly. In the American Association of Scientific Workers there is room for divergent views. In the past four years the organization has profited by the lessons learned from certain errors in the first two years of its existence.

While not saying so outright, Dr. Bridgman's article implies that American scientists should band together to protect freedom in science. I can see no need for such a course. The existing professional societies, from the American Association for the Advancement of Science and Sigma XI, to the American Association of Scientific Workers, form a wholly sufficient bulwark against possible encroachments upon the rights of freedom in science. A new society dedicated exclusively to the defense of freedom in science has little positive contribution to offer. Greater benefits can result from the support of organizations that attempt to analyze and appraise with care various proposals relating to the place of planning in postwar scientific research in the United States. This is not the time for a return to the "ivory tower."

BART J. BOK
HARVARD COLLEGE OBSERVATORY

VISITING RESEARCH PROFESSORSHIPS

THE ranks of retired professors are increasing at an astonishing rate. This calls for some sort of inventory of the contributing factors and a legitimate forecast in higher education. Among the contributing factors to the availability of distinguished professors are the following: (1) rising longevity and improvement in physical and mental health; (2) rise in the number of professors retiring for age in colleges and universities; (3) rise in the number of institutions providing retirement pensions; (4) increase in superior facilities for intensive and sustained projects in research; (5) increased emphasis on research in American universities; (6) prevailing frustration at the time of forced retirement; (7) need of recognized status at this stage; (8) growing recognition of individual differences in health, interests, skills in research and leadership; (9) the tragic need of supplementing the bread-and-butter provisions of retirement plans with opportunities for rounding off a scholarly career in creative work.

In view of these facts it is timely to ask, in the interest of advancement of knowledge and learned service to mankind, what can be done to encourage continuity in creative scholarship on the part of distinguished professors after retirement on an adequate pension plan. One of the first steps for leaders, authorities and associations in higher education might be to recognize this new group by giving them academic status in the continuation of their scholarly pursuits.

While there are manifestly many kinds of overlapping, acquaintance with the present group of retired professors reveals three general classes: (1) those who for reasons of health or other circumstances seek rest and recreation, and welcome freedom from academic activities; (2) those who have an urge to teach, lecture or engage in other special activities on their own initiative; (3) those in good health who are endowed with a zeal for creative work and are entitled to the best facilities for research and writing. For the first group, the retirement is welcome and they should be encouraged to enjoy their earned freedom from academic work. Those of the second group usually have good connections and can transfer to another institution for a year or more of teaching or lecturing under the title of visiting professor or they may engage in other special activities and services, vocational or avocational. It is with the third group that we are here primarily concerned.

In view of the present tendency for the stipulation of retirement plans to deprive these scholars of the privileges and responsibilities for continuity in well-established research projects and for delving into new ventures which are the outgrowth of these in their home institutions, there is urgent need of new concepts and agencies to meet this relatively new situation. A key to the new vantage ground might take the form of a formal implementing of the term "visiting research professor." This should unlock the door to great opportunities by promoting migration as well as by encouraging new devices for the development of a new status in the home institution.

Here it should be observed that the underlying policy of retirement plans, providing for the stepping aside of the old professors to give full sway and responsibility to younger men, is a sound policy and should be mutually advantageous. The adoption of standard retirement plans is a comparatively new venture in higher education and is a blessing to many a retired professor in so far as the bread-and-butter issue is concerned, but in many cases the financial provision is not the primary need of an able professor. He needs access to laboratories, libraries, research institutions, field projects and other forms of public and private highly technical service. He needs time and facilities for productive writing. In many cases he needs and can command very substantial additions or substitutions for his retirement allowance. He needs facilitation of inter-institutional migration and travel. He needs a well-earned and highly honored academic or professional status.

Who, then, needs all these things, of which the pension allowance is but a trifle? It is the professors in this third group, whether they come from small colleges or great universities, who may be at critical points of bringing to rich fruitage the seeds they have sown and cultivated in their professional careers. Their skill and professional proficiency in learned careers may have earned them encores, so that they may now take bows and play extra numbers in service to mankind.

We now have the well-established rungs on the academic ladder in America—the preschool and kindergarten, primary, elementary, secondary, junior college, standard college and graduate school. Now on top of this towering ladder let us put a capstone, the status of visiting research professor. Let universities and industrial and professional institutions enrich themselves by a hearty recognition of their successful sponsoring at this highest level of higher education, let educators announce to their constituency that there is such a new field of operation and encourage them for self-orientation in preparation for this highest venture, and let presidents and directors of higher institutions proceed in an aggressive policy for cooperation and self-help in the promotion of this policy.

The foundations have been contributors to this interest and there is increasing room for their initiative in opening new fields by priming policies and for sustaining activities. The rapidly developing interest in pure and applied science in industry opens new vistas for a short period of employment of retired professors recognized as specialists and authorities in their respective fields. The post-war demand for applied learning in laying foundations for a new world order and a new type of social and political cooperation and organization makes serious demands upon ripe scholarship in concentrated service. The positions open may not be called professorships, but they will have the equivalent academic status in the learned world.

CARL E. SEASHORE
THE STATE UNIVERSITY OF IOWA

GEOMORPHIC SIGNIFICANCE OF VALLEYS AND PARKS OF THE KAIBAB AND COCONINO PLATEAUS, ARIZONA

A LATE-TERTIARY peneplane in the Grand Canyon district has been postulated by C. E. Dutton,[1] W. M. Davis,[2] Douglas Johnson[3] and H. H. Robinson.[4] Davis discussed several lines of evidence for the existence of this peneplane, which he considered to have closed the "plateau cycle" of erosion, or "great denu-

[1] C. E. Dutton, *U. S. Geol. Survey, Monograph II*, 1882.
[2] W. M. Davis, *Bull. Mus. Comp. Zool.*, 38: 107–201, 1901.
[3] Douglas Johnson, *Proc. Boston Soc. Nat. Hist.*, 34: 135–161, 1909.
[4] H. H. Robinson, *Am. Jour. Sci.*, 34: 109–129, 1907; *Jour. Geol.*, 18: 742–763, 1910.

dation," and to have preceded the present canyon-cutting cycle. Much importance was attached to the form of valleys on the Kaibab and Coconino Plateaus. In contrast to the deep, narrow canyons of the Colorado River and its immediate tributaries, valleys on the plateau summits are generally shallow and open, which led Davis to conclude that they represent mature valley forms remaining from the earlier cycle. Robinson employed similar evidence to support a hypothesis of peneplanation in the San Francisco Plateau farther south.

Field study of the valleys and park-like depressions of the Kaibab and Coconino Plateaus by the writer has revealed facts that are incompatible with the two-cycle hypothesis but seem to be the normal consequences of a continuous erosion cycle. The entire area is underlain by the Permian Kaibab and Toroweap limestones. The valleys are of three distinct types, each closely related to a zone of climate and vegetation determined primarily by altitude. The lower flanks of the plateaus, in the semi-arid pinyon-juniper woodland zone below 7,000 feet,[5] have young canyons being actively degraded by intermittent streams. The western yellow pine zone, 7,000 to 8,000 feet, has steep-walled, flat-floored valleys, lacking surface stream channels; fans of slope-wash are built out across the valleys and the valley fill likewise consists of locally derived slope-wash. The Douglas fir zone, above 8,000 feet on the Kaibab Plateau, has a cool, humid climate supporting dense forests of fir, spruce, pine and aspen; valley walls and floors are thickly mantled by slope-wash and rock outcrops are largely concealed; abundant sinkholes occupy both the valley floors and the interstream areas; surface streams are virtually absent and valley bottoms are often undulating, reversing the normal down-valley slope.

A hypothesis of valley abandonment due to the increasing effects of limestone solution at higher elevations adequately explains the above facts. Valleys initially carved by vigorous, youthful streams were deserted as underground drainage dismembered the surface streams. Valleys fell into decay, accumulating a mantle of slope-wash, and were carved by sinks. At progressively lower and drier levels, the effects of solution rapidly diminish, and in the semi-arid pinyon-juniper and lower climatic zones intermittent surface streams continue to incise the valleys.

Davis, Johnson and Robinson considered the contrast between valleys at higher and lower elevations as the result of two erosion cycles. This hypothesis seems unsatisfactory because it fails to explain the close correlation of the three-fold classification of valleys with zones of climate and vegetation. Moreover, it does not consider the abundant features of limestone solution and the absence of stream channels in the waste-choked valleys.

Parks of the Kaibab Plateau are elongate closed depressions forming a north-south trending chain coinciding closely with the structural crest of the Kaibab arch. They may have originated as valleys of longitudinal subsequent streams formed while the resistant Kaibab limestone of the arch was being stripped of its Mesozoic cover, or as subsequent valleys along a series of minor fault lines. Development of underground drainage resulted in diversion of the surface streams, and the valleys became enlarged and deepened into the present solution basins.

If the hypothesis of valley development controlled by limestone solution is accepted in place of the explanation offered by Davis, one of the major lines of evidence for the plateau cycle or great denudation, closing in the development of a widespread peneplane, must be discarded. The results of the writer's study are, therefore, of critical significance in the geomorphic history of the entire Grand Canyon district.

ARTHUR N. STRAHLER
COLUMBIA UNIVERSITY

[5] G. A. Pearson, *U. S. Dept. Agr., Tech. Bull.*, 247: 5–14, 1931.

SCIENTIFIC BOOKS

TEXT-BOOKS OF PHYSICS

Student's Handbook of Elementary Physics. By ROBERT BRUCE LINDSAY. xv + 382 pp. The Dryden Press, Inc. 1943. $2.25.

Electrical Engineering: Basic Analysis. By EVERETT M. STRONG. xii + 391 pp. + 7 plates. John Wiley and Sons, Inc. 1943. $4.00.

Electronic Physics. By L. GRANT HECTOR, HERBERT S. LEIN and CLIFFORD E. SCOUTEN. viii + 355 pp. The Blakiston Company. 1943. $3.75.

University Physics: Part Four, Wave-Motion and Sound. By F. C. CHAMPION. iii + 67 pp. Blackie and Son, Ltd. Interscience Publishers, Inc. 1942. $1.65.

Simplified Physics. By S. A. SMALL and C. R. CLARKE. x + 428 pp. E. P. Dutton and Company, Inc. 1943. $3.00.

General Physics: A Textbook for Colleges. By OSWALD BLACKWOOD. viii + 622 pp. John Wiley and Sons, Inc. 1943. $3.75.

Physics: A Textbook for Colleges. Fourth edition.

By OSCAR M. STEWART. x+785 pp. Ginn and Company. 1944.

Fundamental Physics. By L. W. TAYLOR with the collaboration of F. G. TUCKER. xii+663 pp.+Appendix XL. Houghton Mifflin Company. 1943. $4.00.

Physics. By ERICH HAUSMANN and EDGAR P. SLACK. *United States Naval Academy Edition.* Revision by The Physics Staff, Department of Electrical Engineering, U. S. Naval Academy. vii+857 pp. D. Van Nostrand Company, Inc. 1944. $5.50.

"AND some few to be read wholly with diligence and attention." Professor R. B. Lindsay's "Handbook of Elementary Physics" is one of the few. This book makes its author the roommate and campus buddy of every undergrad that owns a copy. Is a bull session on physics in order? If so, call the bunch together, then open Lindsay's Handbook and read aloud. Ask your questions and they will be answered, for one of the ripest scholars and choicest spirits among teachers of college physics is sitting in.

The life experience of a great teacher of general physics is distilled into these pages. One hundred and thirty of them make "a primer of general physics." Does he mean prim-er or prime-er? Both perhaps, for all is fundamental and simple and clear, and when it has been mastered the mind is primed for much that may turn up in lecture or in text-book or in laboratory or in the big world beyond the walls.

Then one hundred and forty pages make "an illustrated dictionary of terms." If you meet the term or phrase and don't understand it, here it is explained. Nothing is too simple or too abstruse—"Normal to a surface," then "Nuclear atom model." The old and new are dealt with impartially. Archimedes' principle and wave mechanics each receives its inch.

Next follow about thirty pages of "chronological history of physics" from 3000 B.C. to 1940 A.D. Three parallel columns present "developments or discoveries in physics," "contemporary developments in other sciences" and "contemporary political and social events" —a sort of condensed "Nichol's Tables" (2 volumes). Physics has been made by men—men who have lived in the real world, who have "stood upon the shoulders of giants" and have looked far ahead. What an idea to acquire when one is a freshman!

Then ten pages of suggested collateral reading list all the books that one has read or wishes he had read, and owns or wishes that he might own. One lends these books to his pupils and they always come back. Now hand the pupils a printed list and encourage more reading.

A collection of useful formulas, and tables physical, chemical and mathematical, answers to selected problems, and an index complete the book. What a book to have at hand, whether one be a freshman or a senior, a green instructor or an old oldtimer with Indian summer not so far ahead!

Strong's "Electrical Engineering—Basic Analysis" may not be flattered by its inclusion in a list of textbooks of physics, for it is decidedly a book for students of electrical engineering, and it presupposes "mathematics through calculus and one year of physics." It is altogether salutary for teachers of physics to keep in touch with books like this one.

For one thing, books of this type reveal the superstructure that the "one year of physics" will be called upon immediately to help support. And then the engineer sees the world of electrical phenomena from an angle somewhat different from that from which the physicist views it. "One of the distinctive characteristics of a good engineer is his ability to strike an economic balance between purely mental idealism and purely physical accomplishment."

And the teacher of engineering has to reckon with the human factors that present themselves in great variety in the pupils that face him. And when a determined and enlightened effort is made, as in this book, to meet and to direct the human factors, then it is worth while for the teacher of physics to know what the engineer is doing. Let him read the preface and the introduction to this text.

For forty years the reviewer has kept engineering texts on shelves by his desk and has used them. Strong's "Electrical Engineering—Basic Analysis" will be a valuable addition to his collection.

"Electronic Physics," by Hector, Lein and Scouten, has been written for beginners, for school boys and girls, for radio classes, for ground school cadets, for pharmacy classes and for some college freshmen and sophomores. It attempts to present fundamental phenomena of electric charges, of electric currents, of magnetism, of the ultimate structure of matter, of light, x-rays and radio, of natural radioactivity and of transmutation of the elements, and to unify them by employing the electron and proton concepts from title page to index.

The book is well printed and beautifully illustrated. Line diagrams in black and red cause salient features to "stand out on the horizon of" one's comprehension "like Mars at perihelion"—as Elbert Hubbard once wrote from East Aurora.

The book has a highly modern flavor. Galileo and Newton receive no mention. However, its roots strike deep into the past. Gilbert, Roemer, Volta, Galvani, Faraday and Henry are in their usual places of honor.

The book has every appearance of being a praiseworthy attempt to present some of the elements of

physics in terms of concepts of recent origin. In the hands of competent teaching personnel of broad and sound outlook it is probably a highly useful tool of instruction.

Again from "mighty London" comes a part of Professor F. C. Champion's "University Physics." This year it is part four—"Wave Motion and Sound." The contents are well presented in eight short chapters about as one finds these topics presented in our best American text-books for sophomores.

The preface contains a prophecy that is news to the reviewer. He passes it along to his readers.

> Finally, it is becoming more and more recognized, at least as an ideal, that material usually given in formal lectures can be quite as well acquired from good text-books and that lectures will gradually develop into a tuitional tutorial system under which the time and energy of the lecturer can be devoted to the detailed elucidation of difficult points, apt illustrations and demonstrations, the discussion of essays and exercises done by the student, and the exercise of personality to engender an enthusiasm without which a subject remains "dry bones."

"Simplified Physics," a clear explanation of modern science with easily made apparatus and many simple experiments, profusely illustrated by the authors and Charles E. Cartwright, with a chapter on color photography by Lieutenant Charles S. Small, U.S.N.R., is a revised edition of "The Boy's Book of Physics."

In the reviewer's boyhood home, in a closet full of old books, was a copy of "Peck's Ganot." A near relative had studied natural philosophy from "Peck's Ganot" as a school girl in the early 1870's. Her teacher had been Dr. Franklin Taylor, a cousin of the famous Bayard Taylor.

When the reviewer opened "Simplified Physics" and looked at the frontispiece entitled "How a Glass of Water Comes to You" and saw the ocean, and the sun drawing water, and the clouds shedding rain, and the mountain stream, and the reservoir, and the water-works, and the aqueduct, and the suburban houses, and the boy drawing water from the faucet, the door of the old closet opened, "Peck's Ganot" came off the shelf, and the old days of 1890 came to life.

Something went out of young lives when books like "Peck's Ganot" were supplanted by books of a different type. "Simplified Physics" aims to bring that something back. Vivat, crescat, floreat!

There appear to be two schools of thought about freshmen current among physicists. One school appears to see in them a means of support for the graduate students of the department who will be paid to "teach" them. And among the freshmen will be found some with aptitudes for physics and inclinations towards it. They are to be captured and trained by the straight and narrow route to help in the research program of the department even before their undergraduate days are over. Their names will soon be appearing on papers ground out by the departmental mill.

The other school looks upon freshmen as young humans who are to be educated to see human culture at least almost whole, as future citizens who will exhibit broad sympathies and wide interests, as to-morrow's specialists of horizon and balance, as those fortunate young people who are to carry through their lives the real advantages of a truly liberal education.

The next three books to be reviewed are written by men of the latter school.

Blackwood's "Introductory College Physics" has developed through the efforts of its author and the constructive criticisms of his many friends in college and school into the current volume—"General Physics." Open the book and the signs of a broad outlook and general culture are at once evident. "The Slow Progress of Civilization," "The Scientific Method," "Faith in the Uniformity of Nature," these are no plants that grow in shallow soil.

The automobile and the driving of it are called in aid from cover to cover. It is real teaching to convert hobbies, sports and recreations into the tools of a liberal education. The book gives every promise of retaining all the old friends and of making many new ones.

The world of higher education mourns the passing of Professor Oscar Milton Stewart. A great author, a great teacher, a man who brought honor upon the profession of teaching physics has gone to the land of memory. His "Physics—A Text-book for Colleges," first published twenty years ago, has just reached its fourth edition. In it the author has included its best review:

> An appreciation of the facts that we are now living in a world which is fashioned largely by science and that the process has only begun leads many to be ambitious to understand modern scientific methods of thinking and the concepts, principles, and theories of science.
>
> Unfortunately the path of knowledge is rather long and tortuous. These concepts, principles, and methods must be learned step by step. Only through the consideration of many specific cases are the more general ones understood. Technical methods can be understood only after one learns to think technically.
>
> THERE IS NO SHORT CUT.
> BUT TO ONE WHO HAS PATIENCE,
> THE END IS WELL WORTH THE JOURNEY.

Master teacher! Hail and farewell!

From a distinguished college of liberal arts have come Taylor's "Physics: the Pioneer Science," written

for a world at peace, and "Fundamental Physics," its sequel stripped for wartime action. Both books are dedicated to the principle that physics is of its very nature and background a liberal and a cultural subject. And if physicists will teach their science in this spirit then it has a contribution to make to education that as yet is only partly realized. Physics is the foundation of much of technology. And the stories of its coming into being and its present-day content are the stories and the creations of men who strove during recent generations, and who strive to-day, to make the scientific method and the scientific outlook a vital part of human thinking and action.

Teachers of physics have not failed to heed the work of the author of these books. They have called him to positions of leadership and have invited him to expound his philosophy before gatherings that have considered major problems of policy.

Even if the teacher does not select "Fundamental Physics" for his classes, he should read and read again the preface and the epilogue and should absorb much of the spirit that quickens the book.

Hausmann and Slack's "Physics" was first published in 1935. It reached a second edition in 1939. Two years later a special edition for use at the U. S. Naval Academy was brought out by E. W. Thomson. And now the staff in physics at the Naval Academy has revised the special edition.

The members of the staff have aimed to adapt the book still better to the education of a midshipman. They have reconsidered the topics to be treated, the order of their presentation and their adaptation to the more advanced courses in mathematics, engineering, ordnance and navigation that the midshipman will pursue.

And the staff has aimed to introduce "desirable corrections." Their efforts in this direction will appeal to all who, like the reviewer, have taught from the regular edition of the text. One of its arresting characteristics is the large number of "corrections" that need to be made.

As instances (all taken from the second edition, twelfth printing):

(*a*) The physical pendulum oscillates, its center of mass *accelerates*, under equal and opposite forces, that is, under *no force!* (p. 158).

(*b*) The center of oscillation of a physical pendulum is that point at which the concentration of the whole mass of the pendulum would cause no change in its moment of inertia! (p. 159).

(*c*) The pressure arising from weight at a depth h in a liquid of uniform density d, in a uniform field g, is (1) hdg if metric absolute units are used, (2) but hd if British gravitational units be employed! (pp. 183–184).

Have the British at last found a screen against gravitation?!

(*d*) And so on! and on! and ON!

Since "the crimes of Clapham are chaste in Martaban" it may be that such statements are accepted as sound science on the east bank of East River. On other shores, however, these are plain blunders and who uses the book is honor bound to warn his pupils to "weigh and consider" all that they see in print.

The men of the Navy have led the way, let the civilians follow it. Let the cargo of the good ship Hausmann and Slack (of the civilian fleet) be thoroughly inspected. Let all errors, blunders and other questionable goods found on board be jettisoned. And let the space thus cleared be stocked with sterling physics.

And may the men of the Navy continue their conquests, both of islands infested with Japs and of textbooks infested with errors!

THOMAS D. COPE

UNIVERSITY OF PENNSYLVANIA

SPECIAL ARTICLES

FURTHER STUDIES ON THE RELATIONSHIP BETWEEN XANTHOPTERIN, FOLIC ACID AND VITAMIN M*

A NUMBER of more or less contradictory reports concerning the hemopoietic activity of xanthopterin (uropterin) have appeared in the literature in recent years. Tschesche and Wolf[1] found a reticulocyte and red blood cell increase following administration of a very small dose of uropterin to milk-anemic rats. Koschara and Hrubesch[2] stated that uropterin from the sample used by Tschesche and Wolf was assayed by Rominger and found to be entirely inactive. The effects of synthetic xanthopterin[3] and xanthopterin isolated from liver were tested in anemic salmon by Simmons and Norris.[4] Both preparations were highly active. Totter and Day[5] reported that xanthopterin

* Research paper No. 543, Journal Series, University of Arkansas. The expenses of this work were defrayed in part by a grant-in-aid from the Nutrition Foundation. Accepted for publication December 5, 1943.

[1] R. Tschesche and H. J. Wolf, *Zeit. f. physiol. Chem.*, 248: 34, 1937.

[2] W. Koschara and A. Hrubesch, *Zeit. f. physiol. Chem.*, 258: 39, 1939.

[3] R. Purrmann, *Ann. Chem.*, 546: 98, 1940.

[4] R. W. Simmons and E. R. Norris, *Jour. Biol. Chem.*, 140: 679, 1941.

[5] J. R. Totter and Paul L. Day, *Jour. Biol. Chem.*, 147: 257, 1943.

exerted a curative effect on the growth inhibition and leucopenia in succinylsulfathiazole-treated rats. We have had difficulty repeating those results, as have other workers.[6, 7, 8] O'Dell and Hogan[9] have recently stated that xanthopterin is inactive when fed to nutritionally anemic chicks (vitamin B_c deficiency).

In contrast to the irregular effects with rats, xanthopterin in our hands has invariably shown beneficial effects on nutritionally cytopenic monkeys.[10, 11] Incomplete experiments[11] indicate that it not only has a curative action, but also a definite preventive effect on the cytopenia resulting from vitamin M deficiency in the macaque. The preventive effect is not permanent, however, at least in a dosage of 1 mg per day.

substances besides this one. From our own observations and those of Wilson *et al.*[13] it appeared possible that folic acid[14] (vitamin B_c[15]) might be such a compound.

We have recently compared the folic acid content of several substances with their vitamin M activity in monkeys. The data obtained[11] show that the folic acid present (as measured by *S. lactis R* growth stimulation) can account for only a small proportion of the vitamin M activity of some of these supplements, particularly dried pasteurized brewers' yeast.

Wright and Welch[7] have obtained evidence that fresh rat liver is capable of synthesizing extra folic acid from xanthopterin. They suggest that hemopoietically active substances may be produced in the liver from xanthopterin and perhaps other compounds and they imply that these hemopoietic substances may be measured by their effect on the growth of *L. casei* and *S. lactis R.*

TABLE I

FOLIC ACID PRODUCED BY INCUBATING 1 GRAM SAMPLES OF LIVER WITH YEAST* AND WITH XANTHOPTERIN

Series and expt. No.	Kind of liver used with folic acid content†	Substrate tested	Initial folic acid† content of substrate	Folic acid† content after incubation	Extra folic acid† produced per gram of substrate
			µgm	µgm	µgm
R1 (2)	Rat (4.2)	500 mg yeast	2.1	51.0	89.4
(3)	Rat (4.2)	125 µgm xanthopterin	0	13.4	73,600
R2 (23)	Rat (5.0)	250 mg yeast	1.05	25.2	76.6
R3 (32)	Rat (1.7)	125 µgm xanthopterin	0	5.9	33,600
R4 (44)	Rat (5.2)	50 µgm xanthopterin	0	19.0	276,000
(50)	Rat (5.2)	250 mgm yeast	1.05	21.0	59.0
C1 (2)	Chicken (17.0)	100 µgm xanthopterin	0	17.0	0
(5)	Chicken (17.0)	500 mgm yeast	2.1	27.5	16.8
(7)	Chicken (17.0)	500 mgm yeast + 100 µgm xanthopterin	2.1	33.6	61,000‡
M1 (2)	Monkey (0.76)	100 µgm xanthopterin	0	0.92	1,600
M2 (6)	Monkey (0.36)	100 µgm xanthopterin	0	0.36	0
(8)	Monkey (0.36)	250 mgm yeast	1.05	3.5	8.3
(12)	Monkey (0.36)	250 mgm yeast + 100 µgm xanthopterin	1.05	4.5	10,000‡

* "Red Label" dried brewers' yeast, Vitamin Food Company, New York.
† µgm of material of potency 40,000.
‡ Values computed in terms of xanthopterin as the substrate.

Koschara and Haug[12] have determined uropterin photofluorometrically in a number of organs and tissues. The amount contained in liver as reported by these authors is probably too small to account for all of the vitamin M activity exerted by fresh liver. If their method is reliable and if they examined enough representative samples there must be other vitamin M active

A comparison of the distribution of vitamin M with that of these potential "precursors" of folic acid should give valuable evidence concerning the validity of this hypothesis. Accordingly, samples of a brewers' yeast preparation which previously had been tested for activity in the intact monkey were incubated with fresh rat liver, fresh chicken liver and monkey

[6] A. E. Axelrod, P. Gross, M. D. Bosse and K. F. Swingle, *Jour. Biol. Chem.*, 148: 721, 1943.
[7] L. D. Wright and A. D. Welch, SCIENCE, 98: 179, 1943.
[8] F. S. Daft and W. H. Sebrell, *Pub. Health Rep.*, 58: 1542, 1943.
[9] B. L. O'Dell and A. G. Hogan, *Jour. Biol. Chem.*, 149: 323, 1943.
[10] J. R. Totter, C. F. Shukers, J. Kolson, V. Mims and Paul L. Day, *Fed. Proc.*, 2: 72, 1943.
[11] J. R. Totter, C. F. Shukers, J. Kolson, V. Mims and Paul L. Day, *Jour. Biol. Chem.*, in press.
[12] W. Koschara and H. Haug, *Zeit. f. physiol. Chem.*, 259: 97, 1939.
[13] H. E. Wilson, C. A. Doan, S. Saslaw and J. L. Schwab, *Proc. Soc. Exp. Biol. and Med.*, 50: 341, 1942.
[14] H. K. Mitchell, E. E. Snell and R. J. Williams, *Jour. Am. Chem. Soc.*, 63: 2284, 1941.
[15] J. J. Pfiffner, S. B. Binkley, E. S. Bloom, R. A. Brown, O. D. Bird, A. D. Emmett, A. G. Hogan and B. L. O'Dell, SCIENCE, 97: 404, 1943.

liver following the technique of Wright and Welch.[7] The monkey livers were obtained from two vitamin M-deficient animals (*Macaca mulatta*) with leucopenia and anemia. One of these (M1) had died some hours previously from intestinal obstruction, while the other (M2) died after having been given 40 mg of xanthopterin in four days in a belated attempt to prevent its death. Control experiments with liver alone and with xanthopterin added to liver were made. The xanthopterin was synthesized by the method of Purrmann.[8] Folic acid was assayed by the method of Mitchell and Snell,[16] using *S. lactis R* as the test organism. Values obtained in representative experiments are given in the table. Each series of experiments was made on one uniform batch of dispersed liver.

It can be seen from the table that yeast, which has a relatively low preformed folic acid content, is rich in the substances which give rise to folic acid when incubated with fresh liver; 15-fold or greater increases over the preformed folic acid were obtained. The high value of 89 μgm of extra folic acid produced per gram of yeast may be lower than the total amount of precursors present since it could hardly be expected that the synthesis would go to completion under the conditions of the experiment. Such a value for the precursors of folic acid is in much better agreement with the known high vitamin M content of this yeast than is the value for preformed folic acid (4.2 μgm per gram of yeast[11]).

Also supporting the belief that there is a relationship between vitamin M and the precursors of folic acid was the finding that livers from the two vitamin M-deficient monkeys were strikingly low in preformed folic acid. As predicted from our feeding experiments,[11] extra folic acid was produced from xanthopterin by the liver of the animal not receiving the pterin (M1). The small total increase may have been due to the fact that the liver was not fresh. Liver from the other animal (M2) produced extra folic acid from yeast and from xanthopterin when yeast was also added.

As expected from the finding of O'Dell and Hogan,[9] chicken liver failed to produce any extra folic acid (as measured by *S. lactis R* stimulation) from xanthopterin alone. Surprisingly, however, it produced folic acid from xanthopterin in the presence of yeast, and also from yeast alone. If folic acid is identical or isotelic[17] with vitamin B_c this would seem to indicate that the *S. lactis R* method of assay is not suitable for measuring vitamin B_c activity in some crude materials. The difference in behavior of livers from chickens and rats toward xanthopterin may be due to the absence of a required substance from chicken liver which is contained in variable amounts in rat livers. Such a substance is evidently present in yeast.

It would appear from our findings and those of Wright and Welch[7] that from a nutritional standpoint the determination of "potential" (preformed plus extra) folic acid may be of much greater significance than the determination of preformed folic acid.

JOHN R. TOTTER
VIRGINIA MIMS
PAUL L. DAY

SCHOOL OF MEDICINE,
UNIVERSITY OF ARKANSAS

[16] H. K. Mitchell and E. E. Snell, University of Texas Publication, 4137: 36, 1941.

[17] For an explanation of the term "isotelic" see R. J. Williams, SCIENCE, 98: 386, 1943.

VITAMIN A TOXICITY AND HYPOPROTHROMBINEMIA

RODAHL and Moore[1] have recently shown that the toxicity of bear and seal liver to humans may be due to a hypervitaminosis A. The effects of an overdosage of vitamin A have been studied by a number of investigators[2,3,4,5] and they are in general agreement on certain of the symptoms, which are roughening of the skin, rarefaction of bones, alopecia and profuse internal hemorrhage, often subcutaneous.

In an investigation of the mechanism responsible for the spontaneous hemorrhage caused by hypervitaminosis A, it was found that overdosage of vitamin A causes a pronounced hypoprothrombinemia. Doses of approximately 15,000 units of vitamin A per day produced a demonstrable hypoprothrombinemia in white rats within a period of ten days. Both the alcohol and the ester forms of vitamin A were fed in doses of 35,000 to 40,000 units per day, and appear to have had equal effect on the prothrombin level. Carotene in doses of 40,000 units per day was without effect on the prothrombin level in the blood.

This effect of vitamin A overdosage can be controlled by a simultaneous daily administration of vitamin K. A daily dose of 25 micrograms of vitamin K will maintain the normal prothrombin level in the blood of animals fed overdosages of vitamin A. Levels of 10 micrograms or less did not give complete protection.

One experiment will serve to illustrate the results obtained. Sixty-four white rats, having an average body weight of 135.3 grams, were divided into eight groups. Seven groups were fed a synthetic diet con-

[1] K. Rodahl and T. Moore, *Biochem. Jour.*, 37: 166–168, 1943.

[2] L. J. Harris and T. Moore, *Biochem. Jour.*, 22: 1461, 1928.

[3] K. Schuebd, *Med. Welt*, 11: 705, 1937.

[4] E. B. Vedder and C. Rosenberg, *Jour. Nutrition*, 16: 57–68, 1938.

[5] J. A. Collazo and J. S. Rodriguez, *Klinische Woch.*, 12: 1732, 1768, 1933.

taining 71 per cent. sucrose, 20 per cent. vitamin-free casein, 4 per cent. Osborne and Mendel mineral salt supplement, 3 per cent. Celluration and 2 per cent. of a suspension of vitamins A, D and E in Mazola oil. The eighth group was fed ground Purina dog chow. All the animals received daily supplements of the available pure components of the B complex vitamins.[6] Vitamin A was administered by means of fish liver oil concentrate (potency, 825,000 units per gram) or a preparation containing molecular distilled vitamin A (potency, 202,400 units per gram) mixed in the basal diets twice weekly to minimize vitamin A loss through oxidation. The dosage of vitamin K (2 methyl-3-phytyl-1,4-naphthoquinone) was given orally each day. Blood samples for prothrombin determinations were obtained by heart puncture after the animals were on the test diet for ten days, except in the case of those animals showing severe toxicity symptoms. From such animals blood samples were taken two to three days before the conclusion of the test. Prothrombin determinations were made according to the method of Campbell, Smith, Roberts and Link,[7] using 50 per cent. plasma dilution levels.

TABLE 1

Group	Vitamin A per 100 gms of basal ration	Vitamin K	Average clotting time
1	400,000 units (ester)*	none	5.69 min.
2	400,000 units (ester)*	100 γ per day	0.37 "
3	88,000 units (alcohol)*	none	0.39 "
4	176,000 units (alcohol)*	"	2.51 "
5	352,000 units (alcohol)*	"	5.12 "
6	352,000 units (alcohol)†	"	5.54 "
7	352,000 units (alcohol)*	25 γ per day	0.35 "
8	704,000 units (alcohol)*	none	7.17 "

* Basal ration, synthetic.
† Basal ration, ground dog chow.

The animals on this test consumed approximately 10 grams of food daily. Hypothrombinemia was produced within a 10-day period in white rats when fed 17,600 units of vitamin A per day. However, 8,000 to 9,000 units per day did not have any significant effect. At higher levels of vitamin A intake, 35,000 to 40,000 units per day, prothrombin levels of the blood were reduced within the comparatively short period of ten days to such an extent that many of the animals died of cerebral hemorrhage. This effect was obtained with a diet of natural ingredients (dog chow) as well as with the purified casein-sucrose ration. No difference between the effects of the alcohol or ester form of the vitamin was observed.

As shown hypoprothrombinemia is prevented by the administration of 25 micrograms of vitamin K daily. The absolute requirement of the white rat for vitamin K is unknown. This species normally requires no dietary source of this factor, since vitamin K is presumably supplied by the intestinal flora. Fecal counts on the animals showed no significant differences in either the total counts or *E. coli* counts.

Although the experiments indicate that an overdosage of vitamin A results in a hypoprothrombinemia, which can be corrected by the daily administration of vitamin K, there is no evidence that vitamin K is effective in preventing any of the other toxicity symptoms occasioned by hypervitaminosis A. The mechanism by which the overdosage of vitamin A causes hypoprothrombinemia requires further investigation.

ROBERT F. LIGHT
RUTH P. ALSCHER
CHARLES N. FREY
THE FLEISCHMANN LABORATORIES,
STANDARD BRANDS, INC.,
NEW YORK, N. Y.

COTTONSEED PHOSPHOLIPIDS[1]

WOOLLEY[2] has recently described the properties of an inositol-containing phospholipid from soybeans to which he gives the name "soybean lipositol." Observations made during an investigation now discontinued indicate that the phospholipids from the cottonseed resemble soybean lipositol more closely than they do other phospholipids previously described as plant constituents.

A commercial cottonseed phospholipid preparation[3] was stirred with changes of acetone until the phospholipids were in the form of a fine reddish yellow powder. The powder was centrifuged, dried and dissolved in purified ethyl ether. A small amount of insoluble material was removed by centrifugation, and the ether solution was then poured into an excess of acetone. The insoluble fraction was a stable, bright yellow, powdery solid (54 per cent. yield). The results of analyses of this preparation are compared in Table 1 with the data of previous investigators.

The cottonseed phospholipid had an ash content of 10 to 11 per cent. Attempts to remove inorganic salts from the preparation by washing, using the technique suggested by Channon and Foster,[7] resulted in some fractionation as determined by P and N determinations, but did not reduce the ash content. Spectrophotographic analyses of the ash showed strong lines for B and Mg, detectable amounts of Ca, Na, K and Si, and a trace of Zn. The original concentrate had been prepared with the use of boric acid as described

[6] The composition of this supplement is the same as that used by Light, Cracas, Olcott and Frey, *Jour. Nutrition*, 24: 427, 1942

[7] H. A. Campbell, W. L. Smith, W. L. Roberts and K. P. Link, *Jour. Bio. Chem.*, 138: 1–20, 1941.

[1] Contribution XLV from the Cotton Research Foundation Fellowship, Mellon Institute.

[2] D. W. Woolley, *Jour. Biol. Chem.*, 147: 581, 1943.

[3] Dr. M. Mattikow, Refining Inc., Charlotte, N. C., kindly furnished a generous sample of the cottonseed phospholipid concentrate.

TABLE 1

Phospholipid	Phosphorus Per cent.	Nitrogen Per cent.	Ash Per cent.	Fatty acids Per cent.
Cottonseed (present investigation) ...	2.9	1.2	10–11	48
Cottonseed (Thurman[4]) ...	2.6–2.9	0.96	–	–
Cottonseed (Hilditch and Zaky[5]).	2.8	1.6	–	48
Soybean lipositol (Woolley[2])	3.1	0.98	12.1	45
Soybean (Hilditch and Pedelty[6])	3.7	1.4	–	70
Wheat germ (Channon and Foster[7])	3.0	1.5	4.3	56
Lecithin (theory[7]) .	4.0	1.8	none	70

by Thurman.[8] The phospholipid contained 0.6 per cent. Mg, 0.3 per cent. Ca, and 0.03 per cent. K.[9]

Fifteen to 20 per cent. of the phospholipid could be dissolved by extracting with many changes of hot alcohol. This "lecithin" fraction contained 3.1 per cent. P, 1.5 per cent. N, and 2.5 per cent. ash.

After either acid or alkaline hydrolysis, 41 per cent. of the nitrogen was present in the form of amino nitrogen.

The phospholipid was readily soluble in water, and in ether and petroleum ether after the addition of small amounts of water. In 5 per cent. concentration, the solution in water was dark-colored with oil-like viscosity and wetting properties. It possessed antioxidant activity of a high order. When assayed in a preparation of ethyl esters of cottonseed oil fatty acids, 0.1 per cent. increased the induction period from 17 to 195 hours at 70°. The role of lipositols and metallic phosphatidates as antioxidants deserves further study.

The relatively low unsaturation (Iodine Number, 100) of the cottonseed phospholipid fatty acids is responsible, at least in part, for its stability.[10] This property and its availability make it a promising material for further investigation of the composition of plant phospholipids.

T. D. Fontaine supplied many analytical data in this study.

HAROLD S. OLCOTT[11]

MELLON INSTITUTE,
PITTSBURGH, PA.

SCIENTIFIC APPARATUS AND LABORATORY METHODS

PROPOSED USE OF STARCH SPONGES AS INTERNAL SURGICAL DRESSINGS ABSORBABLE BY THE BODY

AN absorbent dressing which, when saturated with a medicament and placed in an incision or a deep wound, would be slowly dissolved and absorbed by the body with gradual release of the medicament would be of considerable value. Sponges obtained by freezing starch pastes[1] have characteristics which suggest their use for such a purpose. As the authors have no facilities for experimentation with animals or for clinical studies, the preparation and characteristics of the starch sponges are described here, with the hope that others may be able to test the medical value of these materials.

Starch sponges are quickly and easily prepared. The following procedure is recommended: A 5 per cent. suspension of purified cornstarch is pasted by heating and then sterilized by heating in an autoclave for 15 to 20 minutes at 15 pounds per square inch gauge pressure. The autoclaved paste is placed in shallow pans or other containers as desired, and frozen slowly, preferably at a temperature just below 0° C. The higher the freezing temperature, the coarser and stronger the resulting sponge. When freezing is complete, the paste is removed from the freezer and allowed to thaw. The resulting spongy mass may be cut into pieces of the required size and shape. Sponges having different textures may be prepared by varying the pasting and freezing conditions, and the kind and concentration of starch used.

Sterile sponges can be prepared by autoclaving the paste and carrying out the rest of the preparation under aseptic conditions, or the final product can be simultaneously toughened and sterilized by immersion in 70 per cent. alcohol. Dried sponges can be sterilized by autoclaving, similarly to absorbent cotton.

Starch sponges are highly absorbent. They will take up 15 to 18 times their own weight of aqueous or alcoholic solutions. Unlike cotton, they are firm enough to retain the absorbed liquid during gentle handling.

These sponges can be air-dried at temperatures up to 105° C., to light, rather brittle masses which return

[4] B. H. Thurman, U. S. Patent No. 2,201,061, 1940.
[5] T. P. Hilditch and Y. A. H. Zaky, *Biochem. Jour.*, 36: 815, 1942.
[6] T. P. Hilditch and W. H. Pedelty, *Biochem. Jour.*, 31: 1964, 1937.
[7] H. J. Channon and C. A. M. Foster, *Biochem. Jour.*, 28: 853, 1934.
[8] B. H. Thurman, U. S. Patent No. 2,150,732, 1939.
[9] Microchemical analyses by C. Tiedcke, New York, N. Y.
[1] The sponge-like character of frozen starch paste was reported by E. A. Scharling, *Ann.*, 49: 315, 1844.
[10] B. H. Thurman, U. S. Patents No. 2,182,767, 1939; 2,201,064, 1940.
[11] Present address: Western Regional Research Laboratory, Albany, Calif.

rapidly to their original soft state when remoistened. In water they are only moderately strong and disintegrate slowly if subjected to mechanical strain. In 70 per cent. alcohol, on the other hand, they remain soft and pliable, but become quite tough and retain their structure almost indefinitely.

There are several methods by which medicinals as, for example, penicillin, sulfathiazole, sulfapyridine or other drugs can be introduced into a starch sponge. The latter may be squeezed nearly dry and filled by dipping into solution. If desired, the sponge can be filled with medicament, dried and remoistened just prior to use. A medicament, such as sulfathiazole, incorporated in the paste prior to freezing, is retained almost completely in the sponge when excess water is expressed. That the sponge would be dissolved and absorbed in the body, with consequent slow release of the medicament, is suggested by the fact that 100 mg portions of dried sponge disperse in 4 to 7 hours at 37° C. in Seitz filter-sterilized beef serum buffered to pH 7.0 to 7.6.

CLAUDE W. BICE
M. M. MACMASTERS
G. E. HILBERT

NORTHERN REGIONAL RESEARCH LABORATORY,
PEORIA, ILL.
BUREAU OF AGRICULTURAL AND INDUSTRIAL CHEMISTRY,
AGRICULTURAL RESEARCH ADMINISTRATION,
U. S. DEPARTMENT OF AGRICULTURE

MOLECULAR WEIGHT BY ISOTHERMIC DISTILLATION

THE previously described "parallel twin capillary" method of J. B. Niederl and A. M. Levy[1,2] for the determination of molecular weight by isothermic distillation has now been improved by reducing the time necessary for interpretable results to 2–3 days instead of weeks. This has been accomplished by placing the capillaries containing the solutions of the standard and the unknown, "opposite" (mouth-mouth) instead of "parallel." Thus the length of the vapor bridge is reduced to 6–8 millimeters.

As before and as illustrated in Fig. 1, the apparatus consists of a capillary desiccator tube (C) and two capillaries, each 25 mm long and 1.5 mm in inner diameter (A and B). Capillary (A) contains the standard solution, while a similar, but opposite capillary (B) contains the unknown. A cotton wad (D) keeps the capillaries in place. The sealed desiccator tube containing the filled capillaries is mounted, by means of a drop of water glass solution, on a microscope slide (E) provided with suitable reference lines (F).

Three trials are usually carried out simultaneously. The unknown is paired with (a) a higher molar, (b) an equimolar and (c) a lower molar standard solution, preferably 0.15, 0.1 and 0.05 molar solutions of azobenzene in acetone. The solutions of standard and unknown are thus placed in competition for solvent through a short vapor bridge in obedience to Raoult's law. Isomolarity between the unknowns and the standard results in no net change of solvent concentrations, and therefore no relative volume changes in the matched pair of capillaries containing equimolar

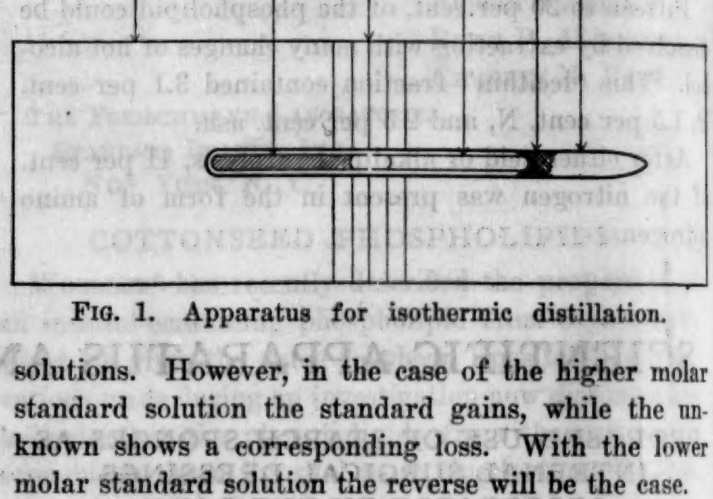

FIG. 1. Apparatus for isothermic distillation.

solutions. However, in the case of the higher molar standard solution the standard gains, while the unknown shows a corresponding loss. With the lower molar standard solution the reverse will be the case.

After an acclimatization period of 24 hours gain and loss of solvent are ascertained by observing the movement of the meniscuses of the solutions by means of a low-powered microscope, possessing a micrometer scale in the eye piece. Readings are taken every 24 hours. With acetone as the solvent two days of observation suffice. The readings are then plotted or tabulated and from these data the results are calculated as described before.[1,2]

The method requires only 25 cu mm of solution per trial, involving as little as 0.5 milligram of substance, which can be recovered. The apparatus consisting of three capillaries is of utmost simplicity.

JOSEPH B. NIEDERL
DAVID R. KASANOF[3]

WASHINGTON SQUARE COLLEGE,
NEW YORK UNIVERSITY

[1] J. B. Niederl and A. M. Levy, SCIENCE, 92: 225, 1940.
[2] J. B. Niederl and V. Niederl, "Micromethods of Quantitative Organic Analysis," 2nd ed., pp. 230–238, New York, N. Y.: J. Wiley and Sons, 1942.
[3] D. R. Kasanof, M.Sc. Thesis, New York University, Graduate School, April, 1944.

BOOKS RECEIVED

BOARDMAN, EDWARD T. *Guide to Higher Aquarium Animals.* Illustrated. Pp. 107. The Cranbrook Institute of Science. $2.00. 1944.

DIETZ, VICTOR R. *Bibliography of Solid Adsorbents.* Pp. lxxxi + 877. United States Cane Sugar Refiners and Bone Char Manufacturers and the National Bureau of Standards. 1944.

ROBINSON, DAVID M. *A Short History of Greece.* Illustrated. Pp. xi + 227. Huxley House. 1936.